

Water Quality Improvement Plan

SPOUT RUN



A plan to reduce bacteria and sediment in the water

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Prepared by

The Virginia Department of Conservation and Recreation

In Cooperation with

Local Stakeholders

The Virginia Department of Environmental Quality
Department of Biological Systems Engineering,
Virginia Tech Center for Watershed Studies

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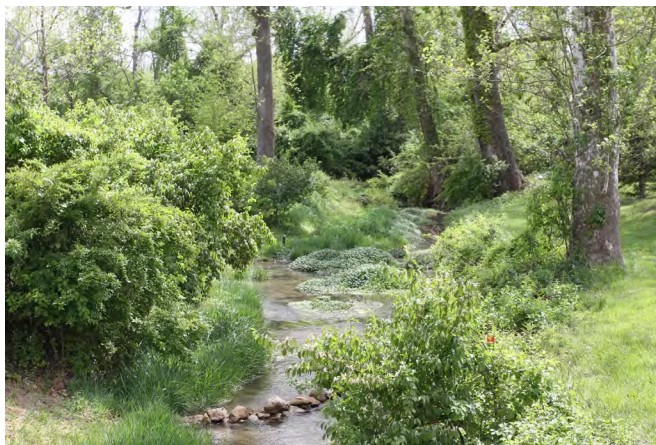
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A Landowner's Guide to Spout Run

Spout Run is a truly **local** stream. Most residents know that Spout Run, including Page Brook and Roseville Run quite literally flow out of the ground in several clean and cold springs: Saratoga, Prospect, Page Brook and Carter Hall to name a few of the larger ones. Prospect Spring is the source of all public water for Boyce and Millwood, meaning that we literally have spring water coming out of our taps! And because the watershed is so small most landowners live within a stones throw of Spout Run or one of it's major feeder streams.

Local residents who have waded into the creek in the summer know it's **COLD** and clear. This is because the springs that create the stream come out of the ground at a consistent 54°F whether it's spring, summer, fall, or winter. Many residents have an appreciation for Spout Run because they've enjoyed a swim or a break from paddling the Shenandoah under the waterfall at the mouth of the stream.

Legend has it that for decades large trout have swum in the cool waters of Spout Run. It is likely that these trout were introduced to the stream by local landowners; however, we now know that they have been reproducing naturally, creating a self-supporting population of wild fish that are calling Spout Run home. If we look back in history, this shouldn't come as a surprise since many valley spring creeks like Spout Run used to be home to native Brook Trout before man came and changed the land. The land that drains to Spout Run was identified as productive, rich farmland very



soon after settlers from the Tidewater region of Virginia and Maryland came to the area. Grist mills were a common sight in the eighteenth century, with the Tilthammer Mill located right at the mouth of Spout Run. The ruins of the Mill can still be seen today. As landowners strived to improve the productivity of their land, they attempted to drain swampy, wet areas and straighten the stream. In addition, current activities like urban and residential development and livestock with direct access to the stream continue to alter the natural state of this stream. Now that we are working to turn back the clock and reduce our human impacts through the restoration of Spout Run, we are hopeful that one day, native fish like brook trout can once again thrive in the stream.

Great progress has been made in recent years to reverse the negative effects of human activities and restore Spout Run to its natural state. Conservation organizations have worked closely with landowners along Spout Run to plant trees along the stream and exclude livestock. Clarke County and the Towns of Millwood and Boyce have also made significant progress in eliminating sewage from the stream by connecting homes with failing septic systems to new sewer lines. But more work is needed before we can call the job done!

What can you do to help restore Spout Run?

Making small changes to our daily lives will make a **BIG** difference in Spout Run. Everyone who lives in the Spout Run watershed (the area of land that drains to the stream) has the ability to help restore the stream, from doing something small like picking up after your pet, or something large like restoring an eroding streambank. Below is a list of a few things you could start out with:

If you're a **homeowner** in the watershed:

- Regularly maintain and pump-out your septic system to make sure it is working properly. You can start by calling a local septic tank pumper and arranging a pump out (schedule every 3-5 years).
- Pick up your pet's waste. Be prepared by taking bags along with you on your walks.
- If you own land along the stream, plant a streamside buffer. If this is not something you have the time or the means to do, then you can save yourself time and money while helping the stream and just stop mowing to the water's edge (a 35-foot buffer of vegetation is best). You can skip the lawn fertilizer too!
- Install a rain barrel at your downspout to catch some of the water coming off of your roof when it rains. Use the water on your flower garden.
- Install a rain garden to catch and treat stormwater coming off of your rooftop and driveway. Look for low spots in your yard where water seems to collect when it rains.

If you're a **farmer** in the watershed:

- Plant a streamside buffer. You can use native grasses, trees, or shrubs. Maintaining the buffer will take some time and effort at first, but as your trees and grasses grow, they will slowly out-compete undesirable invasive plants like thistles.
- Provide your livestock with an alternative water source like a well and fence them out of the stream. If a well is impractical, you could consider installing limited access points along the stream.
- Plant cover crops and reduce tillage to keep valuable soil on your fields instead of in the stream.
- Use a rotational grazing system to prevent overgrazing and maximize your forage production.

For more information on how to get started:

- Technical and financial assistance with agricultural best management practices
Lord Fairfax Soil and Water Conservation District
website: <http://lfswcd.org/> phone: (540) 465-2424, Ext. 3
- Information about septic system maintenance, repairs and replacements
Clarke County Health Department
website: <http://www.vdh.virginia.gov/LHD/LordFairfax/Offices/ClarkeHD.htm> phone: (540) 955-1033
- Expert advice on native plantings for your yard and along the stream
Shenandoah Chapter of the VA Master Naturalist Program
website: <http://www.virginiamasternaturalist.org/shenandoah.html>
- Information about how to install a rain garden and construct a rain barrel
Clarke County Natural Resources Planner
website: <http://www.clarkecounty.gov/planning/environmental-a-water-resource-information.html>

To follow the progress of Spout Run restoration efforts, subscribe to the spoutrun.org website

INTRODUCTION

The [Clean Water Act](#) (CWA) requires that all of our streams, rivers, and lakes meet the state water quality standards.

The CWA also requires that states conduct monitoring to identify polluted waters that do not meet standards. Through our monitoring program, the state of Virginia has found that many streams do not meet state water quality standards for protection of the five beneficial uses: recreation, the production of edible and marketable natural resources, aquatic life, wildlife, and drinking. When streams fail to meet standards they are placed on the state's impaired waters list, and the state must then develop a Total Maximum Daily Load (TMDL) for each pollutant. A TMDL is a “pollution budget” for a stream, meaning that it sets limits on the amount of pollution that a stream can tolerate and still maintain water quality standards. In order to develop a TMDL, background concentrations, point source loadings, and non-point source loadings are considered. Non-point source pollution occurs when pollutants from multiple sources are transported across the land to a body of water when it rains. Point source pollution occurs when pollutants are directly discharged into a stream. Through the TMDL process, states establish water-quality based controls to reduce pollution and meet water quality standards.

Water Quality Problems in Page Brook, Roseville Run and Spout Run

A TMDL was developed for Spout Run and its tributaries in 2010 after water monitoring showed:

- 1) The creeks were violating the State's water quality standard for [bacteria](#), which was based on the concentration of fecal coliform in the water until 2003 (the fecal coliform bacteria count should not exceed a geometric mean of 200 cfu per 100 mL of water for two or more samples taken over a 30-day period, and it should not exceed 400 cfu per 100 mL at any time). In 2003, Virginia switched to an *E. coli* water quality standard after it was found that there was a more positive correlation between contact with *E. coli* and gastrointestinal illness or infection. Consequently, the TMDL for Spout Run was developed for *E. coli*. The *E. coli* standard that became effective January 15, 2003 states that the *E. coli* bacteria count should not exceed a geometric mean of 126 cfu per 100 mL for two or more samples taken over a 30-day period, and it should not exceed 235 cfu per 100 mL at any time.
- 2) The creeks were violating the general (benthic) standard for [aquatic life use](#). This standard states that all state waters should support “the propagation and growth of a balanced indigenous population of aquatic life...” (State Water Control Board, 2006). Based on biological monitoring conducted by the Virginia Department of Environmental Quality (VADEQ), it was concluded that the creeks were not meeting this designation. After an in depth review and analysis of available data by a Technical Advisory Committee, the primary stressor on the aquatic community in Spout Run was identified as [sediment](#) (VADEQ, 2010a).

Creating a TMDL Implementation Plan

Once a TMDL is developed for a stream, the next step is to create a plan that identifies how the pollutant reductions identified in the TMDL can be achieved. A TMDL Implementation Plan describes actions that can be taken by landowners in the watersheds that will result in improved water quality in the stream. There are nine components included in an implementation plan:

1. Causes and sources of bacteria and sediment that will need to be controlled to meet the water quality standards
2. Reductions in pollutants needed to achieve water quality standards
3. Management measures (BMPs) that will need to be implemented to achieve the pollutant reductions
4. Technical and financial assistance needed, associated costs, and the authorities that will be relied upon to implement the plan
5. An information/education component that will be used to enhance public understanding on the project and encourage participation in selecting and implementing best management practices
6. A schedule for implementation of the practices identified in the plan
7. Goals and milestones for implementing best management practices
8. A set of criteria for determining if bacteria and sediment reductions are being achieved and if progress is being made towards attaining water quality standards
9. A monitoring program to evaluate the effectiveness of the implementation effort



REVIEW OF TMDL STUDY

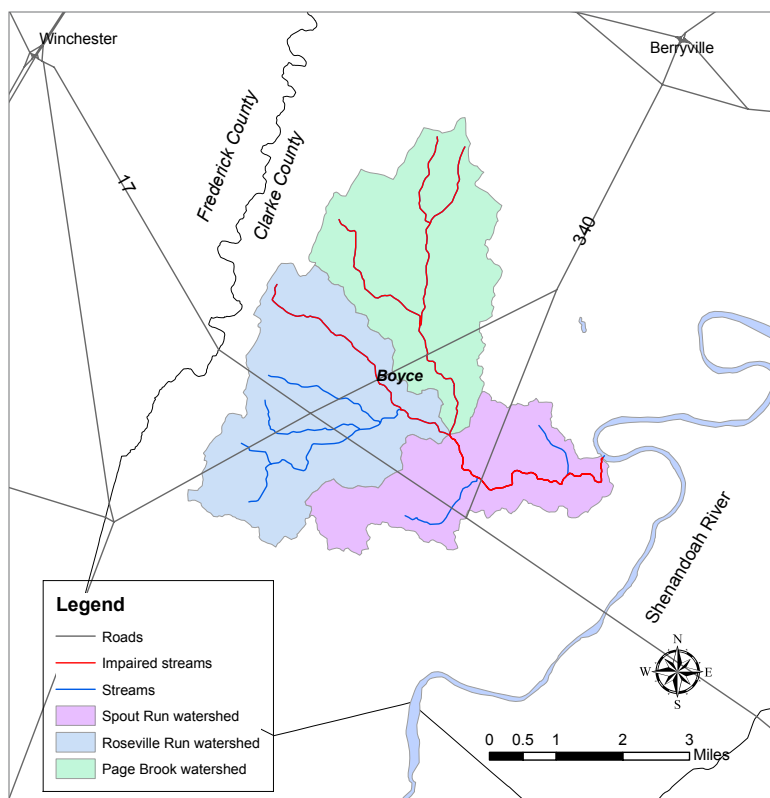


Figure 1. Location of the watersheds

Watershed Characteristics

Spout Run and its tributaries are located in Clarke County in Virginia's Shenandoah River Basin. Page Brook and Roseville Run flow south and east respectively, into Spout Run, which flows east to the Shenandoah River. Land use in the watersheds is predominantly agricultural and forest. The watersheds total approximately 13,711 acres. Spout Run is a low gradient, limestone-dominated stream. Numerous springs have been identified in the watershed, which have a significant influence on stream-flow, water temperature and chemistry in Spout Run. Due to the limestone origin of the springs in the watershed, Spout Run has extremely high alkalinity, total dissolved solids, conductivity and hardness. (VADEQ, 2010a). In addition, marl or Weaver soils are found throughout the riparian zone in the watershed, and are often the predominant substrate within the channel. Marl forms a "crust" on rocks and other materials on the stream bottom, which can be observed in many locations in the stream. These soils are highly erodible, and are an important factor in streambank erosion in the watershed.

The segment of Page Brook impaired by bacteria extends from the headwaters to the confluence with Roseville Run (8.78 miles). The impaired segment of Roseville Run begins at the headwaters and extends to the confluence with Page Brook (3.94 miles). The impaired segment of Spout Run (both bacteria and benthic impairments) stretches from its confluence with Page Brook and Roseville Run to the confluence with the Shenandoah River (3.7 miles) (VADEQ, 2008; VADEQ, 2010b).

Sources of Bacteria

Agricultural runoff, direct deposition of manure in streams by livestock, and wildlife have been identified as the primary sources of bacteria in the creeks. Non-point sources of bacteria in the watersheds include failing septic systems, livestock, wildlife, and domestic pets. Point sources including individual residences can contribute bacteria to streams through their permitted discharges. There are currently two point sources, the Boyce Sewage Treatment Plant and the Prospect Hill Water Treatment Plant, permitted to discharge bacteria in the Roseville Run and Page Brook watershed, respectively.

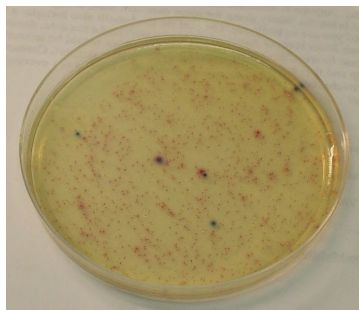
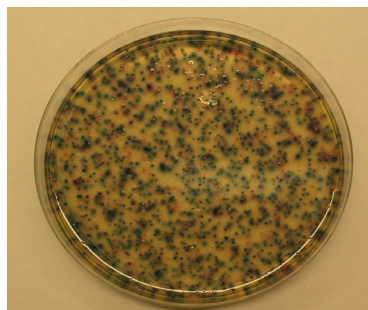


Photo shows coliscan plates, which reveal the presence and abundance of *E.coli* colonies (blue dots) and coliform bacteria colonies (red dots) in a tributary of Middle River in Augusta County where livestock have access to the stream (left) and where they have been excluded (right). Photo: Bobby Whitescarver, NRCS

Goals for Reducing Bacteria

The TMDL study completed for the creeks identified goals for reducing bacteria from the different sources in the watersheds. These goals are based on what it would take to reach the point where the creeks would meet the geometric mean standard for *E. coli* (126 cfu/100mL) and would not violate the instantaneous standard for *E.coli* (235 cfu/100mL) more than 10.5% of the time (Table 1).

Table 1. Goals for bacteria reductions. Note: DD=direct deposition

| Watershed | Fecal Coliform Reduction from Source Category (%) | | | | % Violation of <i>E.coli</i> standard | |
|---------------|---|-----------|---------------------|---------------------------|---------------------------------------|---------------|
| | Straight Pipes | Cattle DD | Agricultural Runoff | Residential/ Urban Runoff | Geometric Mean | Instantaneous |
| Page Brook | 100% | 92% | 50% | 50% | 0% | 6.73% |
| Roseville Run | 100% | 90% | 50% | 50% | 0% | 7.06% |
| Spout Run | 100% | 67% | 50% | 50% | 0% | 4.00% |

Sources of Sediment

Based on the TMDL study results, the major source of sediment in Spout Run is streambank erosion (an estimated 60% of the total sediment load), which is occurring due to poor bank stabilization from lack of vegetative cover in riparian areas in the watershed. The highly erodible soils found throughout the riparian corridor in Spout Run are also thought to play a significant role in the erosion occurring within the stream channel. Degraded pasture land is also a significant source of sediment in Spout Run. Agricultural lands are particularly susceptible to erosion when vegetative cover is minimal such as when pastures are overgrazed or crop fields are tilled and left uncovered. In addition, there are two point sources in the watershed that are permitted to discharge sediment to the river, the Boyce Sewage Treatment Plant discharging into Roseville Run and the Prospect Hill Spring Water Treatment Plant, which discharges in to Page Brook.



Goals for Reducing Sediment



The Spout Run TMDL study includes an assessment of the sources of sediment in the watershed as well as the reductions that are needed from each source in order to restore the benthic community in the streams (Table 2). Significant reductions are called for from streambank erosion and degraded riparian pasture areas since these sources are key sources of sediment in the watersheds. Excess sedimentation from transitional land (land where construction is underway) can be reduced through Erosion and Sediment Control measures.

Table 2. Goals for sediment reductions in Spout Run

| Scenario | Sediment Reduction by Source Category (%) | | | | | | Avg. Annual Sediment Load (T/yr) |
|---------------------|---|----------|---------|---------------------------|-----------------------------|--------------------|----------------------------------|
| | Residential/Urban | Cropland | Pasture | Degraded Riparian Pasture | Transitional (construction) | Streambank Erosion | |
| Existing conditions | 0% | 0% | 0% | 0% | 0% | 0% | 238 |
| TMDL goal | 30% | 30% | 30% | 67% | 30% | 67% | 109 |

COMMUNITY PARTICIPATION



Collecting input from [the local community](#) on conservation and outreach strategies to include in the TMDL Implementation Plan was a critical step in this planning process.

A [public meeting](#) was held on the evening of April 3, 2012 at the Boyce Fire Hall to kick off the development of the implementation plan. This meeting served as an opportunity for local residents to learn more about the problems facing the creeks and work together to come up with new ideas to protect and restore water quality in their community. This meeting was publicized through a press release published in local papers, email announcements, invitations mailed to riparian landowners, and flyers posted throughout the watersheds. The meeting included a presentation by DCR staff on current water quality issues in the watersheds and development of the implementation plan. This presentation was followed by break out sessions to collect local input on characteristics of the watersheds and ideas regarding what to include in the plan. Approximately 60 people attended the meeting. A final public meeting was held on December 5, 2012 at the Powhatan School to present the completed draft plan to the public and collect local input.

Two working groups ([agricultural and residential](#)) were formed in order to discuss implementation and outreach strategies suitable for different land uses in the watersheds. Each working group was made up of stakeholders who were familiar with land use management issues specific to their particular working group focus area. The groups each met 2-3 times during the development of this plan.

The role of the [Agricultural Working Group](#) was to review conservation practices and outreach strategies from an agricultural perspective. During the first agricultural working group meeting, which

was held as a break out session during the first public meeting in April, the group discussed the status of farming in the region and characteristics of typical farms in the watershed. There are a number of horse farms in the area (Clarke County ranks 3rd in Virginia in the number of horses) and the average farm size is around 150 acres. There are very few absentee landowners in the watershed, and the county has worked to preserve agricultural land through sliding scale zoning and conservation easements. The group discussed livestock exclusion practices in the watershed as well as streambank restoration techniques. A second agricultural working group meeting was held at the Boyce Fire Hall on June 26, 2012. The group reviewed BMP scenarios and associated costs, discussed education and outreach strategies, and developed a timeline for implementation. The group discussed the different types of fencing that could be used to exclude livestock from streams and the options for fencing setbacks. Appropriate BMPs for horse farms were discussed as well. It was suggested that manure storage/composting facilities for horse operations would be a good BMP to include as well as BMPs to better manage denuded areas that receive considerable traffic. Cropland BMPs including continuous no-till and cover crops were also discussed. Based on the size of the watershed and participation in BMP programs to date, the group agreed that targeting outreach to certain portions of the watershed may not be necessary and that the goal should be to reach out to all landowners and provide assistance on a first come first serve basis.

The primary role of the [Residential Working Group](#) was to discuss methods needed to reduce human and pet sources of bacteria entering the creeks and residential and urban sources of sediment, recommend methods to identify and correct or replace failing septic systems and straight pipes, and provide input on the BMPs to include in the plan. At their first meeting on April 3rd, the residential working group discussed opportunities for riparian buffers and other restoration projects in the watersheds. The group also discussed how to educate homeowners about septic system maintenance needs. A second residential working group meeting was held on June 11th at Carter Hall Mill. During this meeting, the group discussed opportunities for connections to public sewer and the low number of alternative waste treatment systems that have been installed in the watershed to date. The group suggested that more attention should be given to enforcement of the county's mandatory 3-year septic tank pumpout ordinance. A third meeting was held at the Northern Shenandoah Valley Regional Commission Office on August 27th in order to review final BMP implementation scenarios for urban/residential stormwater BMPs, septic system BMPs and pet waste BMPs. The working group reviewed and provided comments on a series of handouts that included a list of potential BMPs, the extent of implementation needed for each BMP, associated costs, bacteria and sediment reduction efficiencies and a draft implementation timeline.

The [Steering Committee](#) met on October 12th at the Northern Shenandoah Valley Regional Commission Office to discuss plans for the final public meeting and to review a draft of the implementation plan. In addition, the group discussed staging of streambank restoration and suggested that high priority reaches of streambank be identified for targeting in the first five years of implementation. Eroding banks influenced by natural conditions including the presence of marl should be noted as low priority for restoration activities. The committee also recommended a 10 year implementation timeline.

IMPLEMENTATION ACTIONS



An important part of the implementation plan is the identification of specific actions that will [improve water quality](#) in the watersheds.

This section provides a summary of what is needed to achieve the bacteria and sediment reductions specified in the TMDL study. Since this plan is designed to be implemented by landowners on a voluntary basis, it is necessary to identify actions including management strategies that are both financially and technically realistic and suitable for this particular community. As part of this process, the costs and benefits of these actions must be examined and weighed. Once the best actions were identified for implementation, estimates of the number of each action that would be needed in order to meet water quality goals were developed.

Management Actions Selected through [Stakeholder Review](#)

While management actions such as livestock exclusion and correction of failing septic systems were directly prescribed by the TMDL, a number of additional measures were needed to control bacteria and sediment coming from land-based sources and streambanks. Various scenarios were developed and presented to the working groups, who reviewed both economic costs and the water quality benefits. The majority of agricultural best management practices (BMPs) in this plan are included in state and federal agricultural cost share programs that promote conservation. In addition, innovative management practices suggested by local producers and technical conservation staff were considered. The final set of practices identified and the efficiencies used in this study are listed in Table 3. It should be noted that an [adaptive management strategy](#) will be utilized in the implementation of this plan. BMPs that are easiest to implement, provide the greatest water quality benefits, and offer the greatest economic return to landowners will be implemented first. The effectiveness of these practices will be continually evaluated, and adjustments of actions will be made as appropriate. As new technologies and innovative BMPs to address bacteria and sediment become available, these practices should also be evaluated for implementation in the watersheds.

Table 3. Bacteria and sediment reduction efficiencies for best management practices

| BMP Type | Description | Bacteria Reduction | Sediment Reduction | Reference |
|--|---|--------------------|--------------------|-----------|
| Direct deposit | Livestock exclusion from waterway | 100% | N/A | 1 |
| Pasture | Streamside buffer (35-100 feet) | LU Change+50% | LU Change+40% | 2,3 |
| | Improved pasture management (cattle) | 50% | 30% | 2,3 |
| | Improved pasture management (equine) | 50% | 40% | 2,3 |
| | Permanent vegetative cover on critical areas | LU Change | LU Change | 4 |
| | Reforestation of highly erodible pasture/cropland | LU Change | LU Change | 4 |
| | Barnyard runoff controls (equine) | LU Change | N/A | 4 |
| | Manure storage facility (equine) | 80% | N/A | 2 |
| | Manure composting facility (equine) | 80% | N/A | 2 |
| Cropland | Small grain cover crops | 20% | 20% | 3 |
| | Continuous no-till | 70% | 70% | 3 |
| | Sod waterway | 50% | LU Change + 50% | 2,4 |
| | Cropland buffers/field borders | 50% | 50% | 2 |
| Residential/ Urban | Raingarden | 80% | 80% | 3 |
| | Bioretention filter | 80% | 80% | 3 |
| | Bioswale | 80% | 80% | 3 |
| | Manufactured BMPs | 80% | 80% | 3 |
| | Rainwater harvesting | LU Change | LU Change | 4 |
| | Pervious pavement | N/A | 70% | 3 |
| | Turf to trees | LU Change | LU Change | 3 |
| | Riparian buffers | 50% | 50% | 2 |
| | Wetland restoration | 8% | 8% | 3 |
| Streambank erosion | Streambank stabilization | N/A | 25.5lbs/ft | 3* |
| Transitional | Increased Erosion & Sediment Control inspections | N/A | 20% | 3 |
| Straight pipes and septic systems | Septic tank pumpout | 5% | N/A | 2 |
| | Connection to public sewer | 100% | N/A | 1 |
| | Septic system repair | 100% | N/A | 1 |
| | Septic system replacement | 100% | N/A | 1 |
| | Alternative waste treatment system | 100% | N/A | 1 |

References

1. Removal efficiency is defined by the practice
2. VADCR. 2003. Guidance manual for Total Maximum Daily Load Implementation Plans. Available at: www.VADEQ.state.va.us/tmdl/ipguide.html.
3. USEPA-CBP. 2006. Nonpoint source best management practices currently used in Scenario Builder for Phase 5.0 of the Chesapeake Bay Program Watershed Model. Revised 02/09/2011. (*Interim load reduction applied to streambank stabilization)
4. Quantified through land use change in Generalized Watershed Loading Function model simulations.

LIVESTOCK DIRECT DEPOSITION



The TMDL study specifies a 67-92% reduction in the direct deposit of waste into the stream by livestock, making **some form of stream fencing necessary**.

To estimate fencing needs, stream segments that flowed through or were adjacent to pasture were identified using GIS mapping. If the stream segment flowed through a pasture, it was assumed that fencing was needed on both sides of the stream. If a stream segment flowed adjacent to a pasture, it was assumed that fencing was required on only one side of the stream. Not every pasture has livestock on it at any given point in time. However, it is assumed that all pasture areas have the potential for livestock access, meaning that livestock exclusion fencing should be installed. It is expected that the majority of fencing will be accomplished through the VA Agricultural BMP Cost Share Program and federal NRCS cost-share programs. Landowners have a growing number of options when it comes to installing livestock exclusion fencing through these programs. In order to determine the appropriate mix of fencing practices to include in the implementation plan, tax parcel data was utilized in conjunction with local data from the VADCR Agricultural BMP Database to determine typical characteristics of livestock exclusion systems in the region (e.g., streamside fencing length per practice). In addition, input was collected from the Agricultural Working Group, NRCS and the Lord Fairfax SWCD regarding typical components of each system, associated costs, and preferred fencing setbacks. Data on stream fencing already in place was collected and subtracted from the total fencing needed (Table 4).

Table 4. Fencing needs assessment

| Description | Linear Feet of Livestock Exclusion | | | |
|---------------------------|------------------------------------|---------------|-----------|---------|
| | Page Brook | Roseville Run | Spout Run | TOTAL |
| Total fencing possible | 59,014 | 89,221 | 25,056 | 173,291 |
| Fencing installed to date | 34,649 | 2,722 | 11,300 | 48,671 |
| Remaining fencing needed | 22,698 | 77,849 | 8,986 | 109,533 |



A summary of cost share programs available to farmers interested in installing fencing is provided on pages 40-43. Incentive payments vary based on the width of the streamside buffer that is installed between the fence and the stream, and the type of fencing that is installed. The portion of fencing that will be accomplished using different fencing practices was based on historical data and input from farmers and agricultural conservation professionals. Farmers who cannot give up 35 feet or more for a streamside buffer can receive 50% cost share for the installation of exclusion fencing with a ten foot setback, cross fencing, and to provide an alternative water source for their livestock. It is estimated that 11% of total fencing in the watersheds will be installed using this practice (code [LE-2T](#)). If a landowner can afford to give up 35 feet for a buffer along the stream, then they are eligible to receive cost share at a rate of 85% for stream fencing, cross fencing and providing alternative water. It is estimated that 42% of the total fencing

will be installed using this practice (code [LE-1T](#)). The [WP-2T](#) system includes streamside fencing, hardened crossings, and a 35-ft buffer from the stream. This practice includes an up-front cost share payment of 50 cents per linear foot of fence installed to assist in covering fencing maintenance costs. In cases where a watering system already exists, a WP-2T system is a more appropriate choice. Since financial assistance with development of alternative water sources is a significant incentive for farmers to install fencing, this practice is used infrequently because it does not provide cost share for the installation of a well,. Consequently, it was estimated that only 1% of fencing in Spout Run would be accomplished using this practice. For those who are willing to install a 35 foot buffer or larger and plant trees in the buffer, USDA-NRCS's Conservation Reserve Enhancement Program ([CREP](#)) is an excellent option. This practice provides cost share and incentive payments ranging from 50% to 115% for fencing, planting materials, and alternative water source development. It is estimated that 45% of fencing in the watersheds will be installed through this program. The [SL-6AT](#) practice is intended specifically for horse operations and provides 50% cost share. This practice includes streamside fencing, establishment of grazing paddocks, development of heavy use, or sacrifice areas and establishment of walkways to facilitate herd movement. It was estimated that 7% of fencing in Spout Run would be accomplished using this practice (Table 5).

Table 5. Livestock exclusion BMPs

| Watershed | Fencing by Exclusion System Type (<i>linear feet and # of practices</i>) | | | | | | | | | |
|---------------|--|---|--------|----|-------|---|--------|---|-------|---|
| | CREP | | LE-1T | | LE-2T | | SL-6AT | | WP-2T | |
| | Feet | # | Feet | # | Feet | # | Feet | # | Feet | # |
| Page Brook | 13,806 | 3 | 5,198 | 2 | 1,549 | 1 | 2,146 | 1 | 0 | 0 |
| Roseville Run | 30,059 | 6 | 39,459 | 11 | 8,331 | 4 | 5,300 | 4 | 1,300 | 1 |
| Spout Run | 5,560 | 2 | 1,500 | 1 | 1,923 | 2 | 0 | 0 | 0 | 0 |

IMPLEMENTATION ACTIONS FOR PASTURE



Runoff from pastures can carry with it bacteria from manure deposited on the pasture and sediment from exposed soil on its way to the stream.

Improved pasture management through the implementation of a prescribed grazing system and a nutrient management plan can prevent overgrazing by livestock, thereby reducing runoff, increasing filtration and vegetative uptake of pollutants, and allowing farmers to better utilize their pasture acreage. Vegetated buffers are an excellent way to treat runoff from pasture. These buffers act as filters, trapping pollutants before they run into the stream. Farmers can utilize cost share programs to convert highly erodible pasture such as areas with steep slopes and poor vegetative cover to forest. These types of pasture typically produce a lower yield of forage for livestock making them less optimal for grazing or cutting hay. Installation of barnyard runoff controls is an excellent strategy to address runoff from horse farms. This includes the installation of a sacrifice area (625 square ft/horse), diversion of runoff from barn roof tops, and protection of heavy use areas including travel lanes with gravel and filter fabric. Improved distribution of water sources across pastures can also help to prevent formation of denuded areas around barnyards. In addition, manure storage and composting facilities were identified as good ways to reduce bacteria runoff from horse farms (Table 6).

Table 6. Pasture BMPs

| BMP | BMP Acres | | | |
|--|------------|---------------|-----------|-------|
| | Page Brook | Roseville Run | Spout Run | TOTAL |
| Small acreage grazing system (equine) | 282 | 289 | 217 | 788 |
| Grazing systems (cattle) | 812 | 1,482 | 796 | 3,090 |
| Improved pasture management | 880 | 1,307 | 637 | 2,824 |
| Barnyard runoff controls (equine) | 17 | 9 | 5 | 31 |
| Permanent vegetation on critical areas | 255 | 327 | 203 | 785 |
| Riparian buffers (35-100 feet) | 12 | 116 | 18 | 146 |
| Manure storage facility (equine) | 8 | 9 | 5 | 22 |
| Manure composting facility (equine) | 5 | 5 | 3 | 13 |

IMPLEMENTATION ACTIONS FOR CROPLAND



Bacteria and sediment can run off of cropland when soils fertilized with manure are exposed to rainfall. These pollutants will make their way to the stream unless filtering practices like riparian buffers are in place to trap it.

Bacteria and sediment from cropland can end up in a stream unless the appropriate management practices are in place. Bacteria from manure spread on cropland can be reduced either by decreasing the source of the bacteria (spreading less manure or storing it longer so that bacteria will die off) or by the use of filtering practices like streamside buffer plantings and sod waterways. Reducing tillage of the soil, increasing soil organic content and allowing better cover will also reduce the degree of runoff and soil loss from cropland during rain events. Many farmers in Clarke County are already using some form of reduced tillage on cropland. In addition, a large proportion of farmers are planting cover crops to prevent soil loss and retain valuable nutrients in the winter. Consequently, this plan includes a modest amount of these practices since they are already commonly used in the region.

Table 7. Cropland BMPs needed

| BMP | Units | Page Brook | Roseville Run | Spout Run | TOTALS |
|----------------------------------|-------|------------|---------------|-----------|--------|
| Continuous no till | acres | 46 | 28 | 19 | 93 |
| Cover crops (annual acreage) | acres | 23 | 14 | 9 | 46 |
| Cropland buffers | acres | 0 | 3.5 | 1 | 4.5 |
| Sod waterways | acres | 2 | 0.4 | 0.7 | 3.1 |
| Permanent vegetation on cropland | acres | 8 | 2 | 3 | 13 |

STRAIGHT PIPES AND FAILING SEPTIC SYSTEMS



Since [state law requires](#) that failing septic systems and straight pipes be corrected once identified, a 100% reduction in bacteria from these sources is needed.

Estimates of the percentages of households served by failing septic systems and straight pipes (pipes directly discharging untreated sewage into the stream) in the watersheds are shown in Table 8. These estimates were developed as part of the TMDL study. They are based on the age of homes in the watershed, and in the case of straight pipes, the proximity of homes to the stream. Estimates of needed repairs and replacements of failing systems with conventional and alternative systems were based on input from the Health Department and observations from septic system maintenance projects in the region. Based on existing conditions in the watersheds, it was estimated that approximately 5% of septic system replacements would be done with alternative waste treatment systems while the remaining 95% could be done using conventional septic systems. A septic tank pumpout program could be utilized to help educate homeowners in the watersheds about septic system maintenance and to locate and correct failing septic systems. This program could be implemented on a limited basis, targeting homes closest to streams. The estimates shown in Table 8 are based on pumping out septic tanks for 50% of households in each watershed.

Table 8. Residential [wastewater treatment](#) BMPs

| Watershed | Failing septic systems | Straight pipes | Connection to public sewer | Septic system repair | Alternative waste treatment system | Septic system replacement | Septic tank pumpout |
|---------------|------------------------|----------------|----------------------------|----------------------|------------------------------------|---------------------------|---------------------|
| Page Brook | 33 | 4 | 0 | 16 | 2 | 19 | 67 |
| Roseville Run | 41 | 5 | 0 | 20 | 2 | 24 | 85 |
| Spout Run | 25 | 9 | 5 | 13 | 1 | 15 | 60 |
| TOTALS | 99 | 18 | 5 | 49 | 5 | 58 | 212 |

STREAMBANK RESTORATION



According to the Spout Run TMDL, approximately 60% of sediment in the stream is coming from bank erosion, making [streambank restoration critical](#).

Improving stormwater management upstream of eroding banks and excluding livestock from the stream will help to prevent bank erosion. However, additional streambank repairs will be needed in order to reduce erosion to the extent called for in the TMDL. Due to the highly erodible Weaver soils found along Spout Run, there are portions of the stream channel where the banks are severely incised and are 10-15 feet high, some of these sites are forested. There are also sites where livestock have had access to the stream for many years, with the banks showing clear evidence of damage from trampling over time. These different types of sites will require different types of fixes. In the latter case, the banks can be graded back, vegetated and stabilized in conjunction with livestock exclusion. At the forested sites, armoring may be necessary. The steering committee determined that it would be best to focus restoration on sites where ongoing management activities are contributing to erosion rather than the forested sites where historic and natural conditions such as soil type are contributing to erosion. This strategy is further described in the targeting section of this plan.

In order to estimate the extent of streambank erosion occurring in the watershed, Trout Unlimited performed a Bank Assessment for Non-Point Source Consequences of Sediment on several reaches in Spout Run, Roseville Run and Westbrook Run in October 2012 (Rosgen 2001). This method uses two bank erodibility estimation tools to evaluate bank characteristics and streamflow distribution. Data on stream and bank characteristics was collected and utilized to estimate the extent of erosion and the length of streambank restoration needed in each watershed (Table 9). Based on this assessment, it was estimated that 20% of streambanks in the watershed are eroding at an accelerated pace.

Table 9. [Streambank restoration](#) BMPs

| BMP | Miles of bank needing bank restoration | | | |
|------------------------|--|---------------|-----------|-------|
| | Page Brook | Roseville Run | Spout Run | TOTAL |
| Streambank restoration | 3.94 | 5.45 | 3.03 | 12.42 |

IMPLEMENTATION ACTIONS FOR PET WASTE



In order to address bacteria from domestic pets in the streams, some form of **pet waste management** is needed.

A pet waste education program will help pet owners better understand the importance of picking up after their pets, whether it be in their own backyard, their neighborhood, or in public parks. With assistance from the Northern Shenandoah Valley Regional Commission, such an education program could be implemented on a regional scale, with Spout Run serving as a pilot project for a larger initiative. This program will include the development and distribution of educational materials, installation of pet waste stations with collection bags in neighborhoods and public parks, and the promotion of pet waste BMPs including pet waste composters. A pet waste composter allows a homeowner to collect their pet's waste and safely compost it outside. There are several types of composters, some requiring more maintenance than others. A septic tank composter (e.g. Doggie Dooley® system) is inserted in the ground (2-4 feet below the surface) with a lid on top. Pet waste is added to the composter along with water and a special enzyme to accelerate decomposition. Traditional composters may also be used to treat pet waste. It is recognized that these digesters will work best in more compact residential developments like the Towns of Boyce and Millwood. The residential working group recommended adopting a conservative estimate of the number of pet waste composters that would be installed in the watershed since this is a BMP that has not yet been widely implemented, meaning that the extent of public interest is largely unknown (Table 10). If the response to promotion of pet waste composters is very strong in the watershed, then this goal could be increased accordingly.

Table 10. **Pet waste** BMPs

| BMP | Page Brook | Roseville Run | Spout Run | TOTAL |
|-----------------------------|------------|---------------|-----------|-------|
| Pet waste education program | | 1 | | 1 |
| Pet waste composter | 10 | 10 | 10 | 30 |

URBAN & RESIDENTIAL IMPLEMENTATION ACTIONS



In order to treat bacteria and sediment running off of urban and residential land, BMPs to **reduce and filter stormwater runoff** will be necessary.

Riparian buffers and conversion of turf grass to trees are highly cost effective practices when it comes to filtering and reducing stormwater runoff. Rain gardens, bioretention filters and bioswales are specially designed to catch runoff from roads and rooftops and allow it to infiltrate down through the soil where pollutants are filtered out. Manufactured BMPs such as Filterra® units are an effective way to manage stormwater in areas that are already largely paved, making space for BMPs a constraint. These BMPs function similarly to rain gardens and bioretention filters, allowing stormwater runoff to infiltrate into a special soil media designed to filter out pollutants. The residential working group identified a series of additional pilot projects to provide developers and residents with examples of innovative stormwater BMPs including rainwater harvesting and pervious pavement. Roseville Run was identified as the most suitable location for these demonstration projects. The Boyce Fire Hall, Boyce Elementary School and the Powhatan School were identified as potential sites for rainwater harvesting. In addition, evidence of a rare 2-acre calcareous muck fen was recently discovered in the Roseville Run watershed on the Powhatan School property and an adjacent parcel. Restoration of the natural hydrology of this resource will result in water quality benefits through increased filtration of runoff.

Table 11. Urban and Residential **Stormwater** BMPs

| BMP | Units | Page Brook | Roseville Run | Spout Run | TOTALS |
|-----------------------------------|---------------|------------|---------------|-----------|--------|
| Rain gardens | acres treated | 12.85 | 18.80 | 6.90 | 38.55 |
| Bioretention filters | acres treated | 4.85 | 7.55 | 3.85 | 16.25 |
| Riparian buffers | acres | 0 | 1.88 | 4.73 | 6.61 |
| Turf to trees conversion | acres | 14.79 | 21.82 | 8.44 | 45.05 |
| Bioswales | ac treated | 17.70 | 26.35 | 10.75 | 54.80 |
| Manufactured BMPs (e.g. Filterra) | ac treated | 4.85 | 7.55 | 3.85 | 16.25 |
| Rainwater harvesting | ac treated | 0.00 | 0.64 | 0.00 | 0.64 |
| Pervious pavement | acres | 0.00 | 0.25 | 0.00 | 0.25 |
| Wetland restoration | ac treated | 0.00 | 1.6 | 0.00 | 1.6 |

EDUCATION AND OUTREACH



In order to [get landowners involved](#) in implementation, education and outreach and assistance with the design and installation of best management practices will be needed.

C-Spout Run Initiative

The “C-Spout Run” initiative will serve as a key mechanism for completion of future education and outreach activities in the watershed. Currently, the C-Spout Run partnership consists of local government representatives, non profits, and state agencies. These organizations have been working together to promote the restoration of the Spout Run watershed for several years, and remain committed to moving this effort forward. In 2012, partners applied for and were awarded a National Fish and Wildlife Foundation Grant to provide support for restoration projects and education and outreach activities. As part of this project, The Downstream Project will develop a multimedia outreach campaign to promote the C-Spout Run partnership and the projects completed through this initiative. Downstream has already developed a Wordpress blog to share information about the TMDL process, and current activities in the Spout Run watershed. The residential working group suggested using this weblog to develop an online, interactive version of the TMDL implementation plan. In addition, the group suggested developing a restoration game to post on the website, and a series of videos and before and after photos demonstrating the benefits of BMPs. The Downstream Project will also be working with partners to capture a series of streambank restoration projects on video from start to finish including planning and construction, and ending with the reintroduction of trout at the restoration sites. Short progress videos and still photographs will be added to the C-Spout Run Weblog as a video journal of the project. Email and RSS feeds will be used to notify subscribers of postings and progress. At the end of the project the video journal will be combined into a single piece on DVD. This outreach campaign will play a key role in increasing local awareness of water quality issues in Spout Run and increasing the sense of community ownership of this unique resource.

The following additional education and outreach strategies were identified:

Agricultural Programs

- Make contact with landowners in the watersheds to make them aware of cost-share assistance, and voluntary options that are available to agricultural producers interested in conservation
- Provide technical assistance for agricultural programs (e.g., survey, design, layout).
- Develop and distribute educational materials, provide examples of similar projects that have been successful, include before and after photos
- Organize educational programs for farmers including farm tours and field days in partnership with VA Cooperative Extension, partner with the Clarke County Equine Alliance on outreach to horse farms

Residential Programs

- Identify straight-pipes and failing septic systems (e.g., contact landowners through mailings)
- Develop and distribute educational materials (e.g., septic system maintenance guide, information on pet waste composters and stormwater management practices)
- Encourage better enforcement of Clarke County's mandatory 3-yr septic pumpout ordinance
- Implement a regional pet waste education program in partnership with the Northern Shenandoah Valley Regional Commission, promote installation of neighborhood pet waste stations, pet waste composters and appropriate pet waste disposal methods.
- Implement a "Beautiful Buffers Program" to encourage residential property owners to plant trees and shrubs next to the stream. Partner with Clarke County Master Naturalists to design attractive buffer projects that compliment the residential landscape.
- Implement a "Turf to Trees Program" to encourage property owners to convert turfgrass to trees. Work with Piedmont Environmental Council to recruit volunteers to conduct tree plantings.

Staffing Needed for Outreach and Technical Assistance

A critical component in the successful implementation of this plan is the availability of knowledgeable staff to work with landowners on implementing conservation practices. While this plan provides a general list of practices that can be implemented in the watershed, property owners face unique management challenges to implementation of practices. Consequently, technical assistance is a key component to successful BMP implementation. Technical assistance includes [helping landowners identify suitable BMPs](#) for their property, [designing BMPs](#) and [locating funding](#).

The staffing level needed to implement this plan was estimated based on discussions with stakeholders and the staffing levels used in similar projects. It was determined that two positions would be needed for agricultural and residential/urban implementation. The Lord Fairfax Soil and Water Conservation District could house an agricultural technician, while Clarke County could potentially house a residential/urban technician who would work on both stormwater management and septic system outreach and BMP implementation.

IMPLEMENTATION COSTS



Costs: Agricultural BMPs

The costs of agricultural best management practices included in the implementation plan were estimated based on data for Clarke County from the VADCR Agricultural BMP Database, the 2011 NRCS Cost List and considerable input from Lord Fairfax SWCD and NRCS staff. Additional input was collected from Prince William SWCD staff regarding the cost of agricultural BMPs for horse farms based on their experience with their Chesapeake Bay Friendly Horse Farm Project.

The total cost of livestock exclusion systems includes not only the costs associated with fence installation, repair, and maintenance, but also the cost of developing alternative water sources for LE-1T, LE-2T, CREP and SL-6AT practices. The cost of fence maintenance was identified as a deterrent to participation. Financial assistance possibilities for maintaining fences include an annual 25% tax credit for fence maintenance, and an up front incentive payment on \$0.50 per linear foot to maintain stream fencing as part of the WP-2T practice; however, this practice has not been commonly used in the watershed since it does not provide cost share for alternative water systems. In addition, the average cost of fence maintenance is typically significantly higher. In developing the cost estimates for fence maintenance, a figure of \$3.50/linear foot of fence was used. It was estimated that approximately 10% of fencing would need to be replaced over the timeline of this plan.

The majority of agricultural practices recommended in the implementation plan are included in state and federal cost share programs. These programs offer financial assistance in implementing the practices and may also provide landowners with an incentive payment to encourage participation. Consequently, when assessing costs it is important to consider both the potential cost to the landowner as well as the cost to state and federal programs. Table 12 shows total agricultural BMP costs by watershed.

Table 12. Estimated agricultural BMP costs by watershed.

| Practice | Cost share code | Units | Unit cost | Cost by watershed | | |
|--|-----------------|----------|-----------|--------------------|--------------------|------------------|
| | | | | Page Brook | Roseville Run | Spout Run |
| Livestock exclusion with riparian buffers | CREP | system | \$56,379 | \$171,686 | \$362,507 | \$85,979 |
| | WP-2T | system | \$13,900 | \$0 | \$5,084 | \$0 |
| | LE-1T | system | \$41,885 | \$72,409 | \$460,748 | \$53,231 |
| | SL-6AT | system | \$33,918 | \$20,000 | \$80,000 | \$0 |
| Livestock exclusion with reduced setback | LE-2T | system | \$31,049 | \$29,237 | \$127,945 | \$60,159 |
| Livestock exclusion fence maintenance (20 yrs) | N/A | feet | \$3.50 | \$7,944 | \$27,247 | \$3,145 |
| Improved pasture management | EQIP (529, 512) | acres | \$100 | \$87,990 | \$130,702 | \$63,690 |
| Permanent vegetation on critical areas | FR-1 | acres | \$1,200 | \$306,424 | \$392,512 | \$243,120 |
| Riparian buffers on pasture | FR-3, WQ-1 | acres | \$1,000 | \$12,181 | \$115,978 | \$18,018 |
| Barnyard runoff controls | SL-6AT | acres | \$20,000 | \$340,000 | \$180,000 | \$90,000 |
| Riparian buffers on cropland | CP-33, WQ-1 | acres | \$1,000 | \$0 | \$3,483 | \$918 |
| Sod waterways | WP-3 | acres | \$1,600 | \$2,613 | \$662 | \$1,052 |
| Continuous no-till | SL-15A | acres | \$100 | \$4,620 | \$2,820 | \$1,860 |
| Cover crops | SL-8B | acres | \$30 | \$693 | \$423 | \$279 |
| Permanent vegetation on cropland | SL-1 | acres | \$175 | \$1,348 | \$324 | \$543 |
| Manure storage facility (horses) | N/A | facility | \$12,160 | \$94,787 | \$113,818 | \$59,098 |
| Manure composting facility (horses) | N/A | facility | \$16,000 | \$76,400 | \$83,200 | \$43,200 |
| TOTAL ESTIMATED COST | | | | \$1,228,332 | \$2,087,453 | \$724,292 |

Costs: Residential BMPs

The costs of recommended residential BMPs shown in Table 13 were estimated using:

- 1) Cost data Culpeper County where a residential septic system maintenance program was implemented in the past 5 years.
- 2) Input from the Clarke County Health Department and the Residential Working Group.
- 3) Input from local septic system contractors

Table 13. Estimated residential BMP costs by watershed.

| Practice | Cost share code | Units | Unit cost | Cost by watershed | | | |
|---|-----------------|------------|-----------|-------------------|------------------|------------------|------------------|
| | | | | Page Brook | Roseville Run | Spout Run | TOTAL |
| Pet waste education program | N/A | program | \$6,000 | \$2,000 | \$2,000 | \$2,000 | \$6,000 |
| Pet waste composters | N/A | composter | \$100 | \$1,000 | \$1,000 | \$1,000 | \$3,000 |
| Septic tank pumpout | RB-1 | pumpout | \$250 | \$16,750 | \$21,250 | \$15,000 | \$53,000 |
| Connection to public sewer | RB-2 | connection | \$20,000 | \$0 | \$0 | \$100,000 | \$100,000 |
| Septic system repair | RB-3 | repair | \$3,000 | \$48,000 | \$60,000 | \$39,000 | \$147,000 |
| Conventional septic system replacement | RB-4 | system | \$8,000 | \$120,000 | \$152,000 | \$96,000 | \$368,000 |
| Conventional septic system replacement w/pump | RB-4P | system | \$10,000 | \$40,000 | \$50,000 | \$30,000 | \$120,000 |
| Alternative waste treatment system | RB-5 | system | \$22,000 | \$44,000 | \$44,000 | \$22,000 | \$110,000 |
| TOTAL ESTIMATED COST | | | | \$271,750 | \$330,250 | \$305,000 | \$907,000 |

Costs: Streambank Restoration Practices

Streambank restoration cost estimates were developed based on the cost of recently completed restoration projects in the City of Harrisonburg and estimates developed by Trout Unlimited staff for the C-Spout Run NFWF Grant Proposal (Table 14). It is expected that costs could be higher if a professional engineer was contracted for design services. Potential sources of in kind design support include Trout Unlimited and the Virginia Department of Game and Inland Fisheries.

Table 14. Estimated streambank restoration costs by watershed.

| Practice | Units | Unit cost | Cost by watershed | | | |
|------------------------|-----------|-----------|-------------------|---------------|-------------|-------------|
| | | | Page Brook | Roseville Run | Spout Run | TOTAL |
| Streambank restoration | linear ft | \$75 | \$1,562,851 | \$2,159,469 | \$1,198,916 | \$4,921,236 |

Costs: Residential & Urban Stormwater BMPs

Stormwater BMP cost estimates were developed with input from state and local government staff and contractors. Budgets from a series of recently completed stormwater BMP pilot projects in Rockingham County and the Cities of Harrisonburg and Staunton funded through grants from DCR were also utilized to develop estimates. Cost estimates are shown for each watershed in Table 15.

Table 15. Urban and residential stormwater BMP costs

| Practice | Units | Unit cost | Cost by watershed | | | |
|-----------------------------|------------|-----------|-------------------|--------------------|------------------|--------------------|
| | | | Page Brook | Roseville Run | Spout Run | TOTAL |
| Rain gardens | ac treated | \$9,000 | \$115,650 | \$169,200 | \$62,100 | \$346,950 |
| Riparian buffers | acres | \$3,500 | \$0 | \$6,567 | \$16,555 | \$23,122 |
| Turf to trees | acres | \$3,500 | \$51,765 | \$76,370 | \$29,540 | \$157,675 |
| Bioswales | ac treated | \$15,000 | \$265,500 | \$395,250 | \$161,250 | \$822,000 |
| Bioretention filters | ac treated | \$17,500 | \$84,875 | \$132,125 | \$67,375 | \$284,375 |
| Manufactured BMPs | ac treated | \$20,000 | \$97,000 | \$151,000 | \$77,000 | \$325,000 |
| Rainwater harvesting | ac treated | \$100,000 | \$0 | \$64,000 | \$0 | \$64,000 |
| Pervious pavement | acres | \$261,360 | \$0 | \$65,340 | \$0 | \$65,340 |
| Wetland restoration | acres | \$15,000 | \$0 | \$30,000 | \$0 | \$30,000 |
| TOTAL ESTIMATED COST | | | \$614,790 | \$1,089,852 | \$413,820 | \$2,118,462 |

Table 16. Total estimated costs of full BMP implementation

| BMP Type | Page Brook | Roseville Run | Spout Run | TOTAL |
|----------------------------------|--------------------|--------------------|--------------------|---------------------|
| Agricultural | \$1,228,332 | \$2,087,453 | \$724,292 | \$4,040,077 |
| Residential (septic & pet waste) | \$271,750 | \$330,250 | \$305,000 | \$907,000 |
| Residential & urban stormwater | \$614,790 | \$1,089,852 | \$413,820 | \$2,118,462 |
| Streambank restoration | \$1,562,851 | \$2,159,469 | \$1,198,916 | \$4,921,236 |
| TOTAL | \$3,677,723 | \$5,667,024 | \$2,642,028 | \$11,986,775 |

Costs: Technical Assistance

Technical assistance costs were estimated for 2 full time positions using a cost of \$60,000/position per year. This figure is based on the existing staffing costs included in the Virginia Department of Conservation and Recreation's grant agreements with the Soil and Water Conservation Districts across the state to provide technical assistance to landowners in TMDL implementation watersheds. Based on the 10 year timeline of this plan (described in great detail in the Implementation Timeline section of this plan), this would make the total cost of technical assistance approximately \$1.2M. When factored into the cost estimate for BMP implementation shown in Table 16, this would make the total cost of implementation approximately **\$13.19M**.

IMPLEMENTATION BENEFITS



The primary benefit of implementing this plan will be **cleaner water** in Spout Run and its tributaries.

Specifically, *E. coli* contamination in the creeks will be reduced to meet water quality standards, and sediment loading will be reduced to support a healthy aquatic community. It is hard to gage the impact that reducing *E. coli* contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, the incidence of infection from *E. coli* sources through contact with surface waters should be reduced considerably following the implementation of the measures outlined in this plan.

An important objective of the implementation plan is to foster continued economic vitality. This objective is based on the recognition that healthy waters improve economic opportunities for Virginians and a healthy economic base provides the resources and funding necessary to pursue restoration and enhancement activities. The agricultural, urban and residential practices recommended in this document will provide economic benefits to the community, as well as the expected environmental benefits. Specifically, alternative (clean) water sources, exclusion of cattle from streams, prescribed grazing, and private sewage system maintenance will each provide economic benefits to land owners. Additionally, money spent by landowners and other stakeholders in the process of implementing this plan will stimulate the local economy.

Benefits: Agricultural Practices

It is recognized that every farmer faces unique management challenges that may make implementation of some BMPs more cost effective than others. Consequently, costs and benefits of the BMPs recommended in this plan must be weighed on an individual basis. The benefits highlighted in this section are based on general research findings. Additional economic costs and benefits analyses of these prac-

tices at the local level was identified as a much needed outreach tool by the steering committee and agricultural working group.

Restricting livestock access to streams and providing them with clean water source has been shown to improve weight gain and milk production in cattle (Zeckoski et al., 2007). Studies have shown that increasing livestock consumption of clean water can lead to increased milk and butterfat production and increased weight gain (Landefeld et al, 2002). Table 17 shows an example of how this can translate into economic gains for producers. In addition, keeping cattle in clean, dry areas has been shown to reduce the occurrence of mastitis and foot rot. The VCE (1998) reports that mastitis costs producers \$100 per cow in reduced quantity and quality of milk produced. Installation of streamside fencing and well managed loafing areas will reduce the amount of time that cattle have access to these areas. Implementing a prescribed grazing management strategy in conjunction with a providing livestock with a clean water source will also provide economic benefits for the producer. Standing forage utilized directly by the grazing animal is less costly and of higher quality than forage harvested with equipment and fed to the animal.

Table 17. Example of increased revenue due to installing off-stream waterers (Surber et al., 2005)

| Typical calf sale weight | Additional weight gain due to off-stream waterer | Price | Increased revenue due to off stream waterer |
|--------------------------|--|---------------|---|
| 500 lb/calf | 5% or 25 lb | \$0.60 per lb | \$15 per calf |

Note: Table from Zeckoski et al. (2007)

Benefits: Residential Practices

The residential program will play an important role in improving water quality since human waste can carry human viruses in addition to bacterial and protozoan pathogens. In terms of economic benefits to homeowners, an improved understanding of on-site sewage treatment systems, including knowledge of what steps can be taken to keep them functioning properly, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. The average septic system will last 20 to 25 years if properly maintained. Proper maintenance includes: knowing the location of the system components and protecting them (e.g., not driving or parking on top of them), not planting trees where roots could damage the system, keeping hazardous chemicals out of the system, and pumping out the septic tank every 3 to 5 years. The cost of proper maintenance, as outlined here, is relatively inexpensive (\$250 per pumpout) in comparison to repairing or replacing a system (\$6,000 to \$22,500).



In addition to the benefits to individual landowners, the economy of the local community will be stimulated through expenditures made during implementation, and the infusion of dollars from funding sources outside the impaired areas. Building contractors and material suppliers who deal with septic system pump-outs, private sewage system repair and installation, fencing, and other BMP components can expect to see an increase in business during implementation.

Benefits: Residential and Urban Stormwater Practices

The primary benefits of stormwater management practices to private property owners include flood mitigation and improved water quality. A 2004 study assessing the economic benefits of stormwater management showed that these services can be valued at 0-5% of the market value of a home (Braden and Johnston, 2004). In addition, urban BMPs have a number of economic benefits to localities. Increased retention of stormwater on site can lower peak discharges, thereby reducing the drainage infrastructure needed to prevent flooding. This can result in cost savings to local governments through reduced engineering and land acquisition costs, and reduced materials and installation costs for stormwater culverts and streambank armoring to prevent scour. Lastly, implementation of urban BMPs greatly reduces soil erosion and sediment transport to our rivers, streams and lakes. A 1993 study of the economic cost of erosion-related pollution showed that national off-site damages from urban sediment sources cost between \$192 million and \$2.2 billion per year in 1990 dollar values (Paterson et al, 1993). This cost range would be far greater today if adjusted for inflation.

Benefits: Establishment of a Coldwater Fishery



Spout Run receives considerable baseflow from a series of springs located throughout the watershed. These springs significantly influence the water chemistry and temperature of the stream, giving rise to conditions that are suitable to support a coldwater trout fishery. A number of angling enthusiasts in the watershed have expressed an interest in working with partners at the Virginia Chapter of Trout Unlimited and the Department of Game and Inland Fisheries to create suitable in stream conditions for trout survival and reproduction. These efforts are part of a larger Interstate 81 Coldwater Area Restoration Initiative that is being led by Trout Unlimited and the Department of Game and Inland Fisheries. The goals established in this TMDL implementation plan will directly support this effort through the creation of riparian and in-stream habitat and water quality conditions necessary to support a viable trout population in Spout Run.

The anticipated economic benefits of these efforts are substantial. According to a 2010 U.S. Fish and Wildlife Service Study of trout fishing in the United States, there were approximately 138,000 trout

anglers (16 years or older) in Virginia in 2006, each of whom spent an average of 5 days a year fishing. This translated into considerable retail sales and state and federal tax revenues. Nationally, trout anglers spent an estimated \$1.06 billion in 2006 on food and lodging for fish trips. In addition, anglers spent \$32,362,000 and \$18,654,000 on public and private land use fees respectively for fishing in 2006. Trout fishing related expenses generated \$965,201,922 in federal tax revenues in 2006 and \$807,005,252 in state and local tax revenues across the county (U.S. Fish and Wildlife Service, 2010). Consequently, it is expected that the creation of a viable trout fishery on Spout Run would result in considerable economic benefits to state and local governments, private landowners and business owners in Clarke County and the Towns of Boyce and Millwood.

Benefits: Watershed Health

Focusing on reducing bacteria and sediment loads in the Spout Run watershed will have associated watershed health benefits as well. Reductions in streambank erosion, excessive nutrient runoff, and water temperature are additional benefits associated with streamside buffer plantings. In turn, reduced nutrient loading and erosion and cooler water temperatures improves habitat for fisheries, which provides associated benefits to anglers and the local economy. The economic benefits of a thriving fishery including stocking operations (put-and-take/ put-and-grow) are substantial as noted above.

Riparian buffers can also improve habitat for wildlife such as ground-nesting quail and other sensitive species. Data collected from Breeding Bird Surveys in Virginia indicate that the quail population declined 4.2% annually between 1966 and 2007. Habitat loss has been cited as the primary cause of this decline. As a result, Virginia has experienced significant reductions in economic input to rural communities from quail hunting. The direct economic contribution of quail hunters to the Virginia economy was estimated at nearly \$26 million in 1991, with the total economic impact approaching \$50 million. Between 1991 and 2004, the total loss to the Virginia economy was more than \$23 million from declining quail hunter expenditures (VDGIF, 2009). Funding is available to assist landowners in quail habitat restoration (see Funding Sources section).

A [calcareous muck fen](#), which is an extraordinarily rare type of wetland, has been identified on the Powhatan School property and an adjacent parcel in the Roseville Run watershed. This ecosystem type is ranked as critically imperiled with only a few known occurrences in the world (Fleming et. al, 2004).



Photo: VADCR, Natural Heritage

Restoring this wetland would be of significant value to watershed health with respect to both ecological diversity and water quality. The natural hydrology of this 2-acre site has been altered by human activities over the years, as has the vegetation. Deep, hydric muck soils have high calcium levels and should remain more or less permanently saturated or flooded by perched groundwater or seepage inputs. Vegetation is marsh-like and characterized by coarse emergent species (Fleming et. al, 2004).

GOALS AND MILESTONES



The end goal of implementation is **restored water quality** in Spout Run and its tributaries. It is expected that this will occur over a **10-year** period.

Two types of milestones will be used to evaluate progress over the 10 year period: implementation milestones and water quality milestones. The implementation milestones establish goals for the extent of the different best management practices installed within certain time frames, while the water quality milestones establish the corresponding goals for improvements in water quality.

Following the idea of a staged implementation approach, resources and finances will be concentrated on the most cost-efficient control measures and areas of highest interest first. For instance, the TMDL study indicated that direct deposit of manure into streams by livestock constitutes approximately 23% of the total bacteria load in Spout Run. Concentrating on implementing livestock exclusion fencing within the first several years may provide the highest return on water quality improvement with less cost to landowners. The timeline for implementation has been divided into two stages: 2013–2017 and 2018–2022. Resources will be concentrated on the most cost-efficient best management practices first. Table 18 shows the cost of BMP implementation in each watershed at each stage while tables 19-21 show implementation and water quality improvement goals for each watershed in each implementation stage.

Table 18. BMP implementation costs by stage

| Stage | Page Brook | Roseville Run | Spout Run | TOTAL |
|----------------------|-------------|---------------|-------------|--------------------|
| Stage 1 (Years 1-5) | \$1,793,742 | \$2,954,089 | \$1,222,680 | \$5,970,510 |
| Stage 2 (Years 6-10) | \$1,883,980 | \$2,712,933 | \$1,419,346 | \$6,016,260 |

Table 19. Timeline for implementation in the [Page Brook](#) watershed

| BMP Type | BMP | Units | Stage 1 | | Stage 2 | |
|---|--|-------------------|----------|--------------------|----------|--------------------|
| | | | Extent | % Land use treated | Extent | % Land use treated |
| Direct deposition | Livestock exclusion w/riparian buffers | feet | 16,919 | 74% | 4,230 | 19% |
| | Livestock exclusion w/reduced setback | feet | 1,239 | 5% | 310 | 1% |
| Pasture | Small acreage grazing system (equine) | acres | 226 | 8% | 56 | 2% |
| | Grazing system | acres | 649 | 23% | 163 | 6% |
| | Improved pasture management | acres | 226 | 8% | 654 | 24% |
| | Permanent vegetation on critical areas | acres | 106 | 4% | 150 | 5% |
| | Riparian buffers | acres | 10 | 0.7% | 2 | 0.1% |
| | Barneyard runoff controls (equine) | acres | 8 | 23% | 9 | 28% |
| Cropland | Continuous no till | acres | 32.34 | 21% | 13.86 | 9% |
| | Cover crops | acres | 23.10 | 15% | 0.00 | 0% |
| | Sod waterways | acres | 0.00 | 0% | 1.63 | 4% |
| | Permanent vegetation on cropland | acres | 3.08 | 2% | 4.62 | 3% |
| Manure storage | Manure storage facility (equine) | facility | 3 | 16% | 5 | 29% |
| | Manure composting facility (equine) | facility | 2 | 9% | 3 | 16% |
| Residential Septic | Septic tank pumpout | pumpout | 67 | 50% | 0 | 0% |
| | Septic system repair | repair | 16 | 43% | 0 | 0% |
| | Conventional septic system | system | 15 | 41% | 0 | 0% |
| | Conventional septic system w/pump | system | 4 | 11% | 0 | 0% |
| | Alternative waste treatment | system | 2 | 5% | 0 | 0% |
| Residential/ Urban Stormwater | Raingardens | ac treated | 7.71 | 2% | 5.14 | 1% |
| | Bioretention filters | ac treated | 1.94 | 1% | 2.91 | 1% |
| | Turf to trees | acres | 10.35 | 3% | 4.44 | 1% |
| | Bioswales | ac treated | 7.08 | 2% | 10.62 | 3% |
| | Manufactured BMPs | ac treated | 1.94 | 1% | 2.91 | 1% |
| Transitional | Increased E&S enforcement | acres/yr | 2.3 | 100% | 2.3 | 100% |
| Pet waste | Pet waste education program | program | 0.33 | 100% | 0.00 | 0% |
| | Pet waste composters | composter | 5 | 2% | 5 | 2% |
| Streambank erosion | Streambank stabilization | linear ft of bank | 8,335 | 31% | 12,503 | 46% |
| Average annual fecal coliform load (cfu/yr) | | | 8.97E+12 | | 4.83E+12 | |
| % Violation of Instantaneous E. coli standard (235 cfu/100mL) | | | 15.87% | | 7.22% | |
| % Violation of Geometric mean E. coli standard (126 cfu/100mL) | | | 30% | | 0% | |
| Average annual sediment load (T/yr): Page Brook, Roseville, Spout | | | 162.85 | | 109.22 | |

Table 20. Timeline for implementation in the [Roseville Run](#) watershed

| BMP Type | BMP | Units | Stage 1 | | Stage 2 | |
|---|--|------------|----------|--------------------|----------|--------------------|
| | | | Extent | % Land use treated | Extent | % Land use treated |
| Direct deposition | Livestock exclusion w/riparian buffers | feet | 60,894 | 78% | 15,224 | 19% |
| | Livestock exclusion w/reduced setback | feet | 6,665 | 9% | 1,666 | 2% |
| Pasture | Small acreage grazing system (equine) | acres | 232 | 6% | 58 | 2% |
| | Grazing system | acres | 1,186 | 31% | 279 | 7% |
| | Improved pasture management | acres | 355 | 9% | 952 | 25% |
| | Permanent vegetation on critical areas | acres | 147 | 4% | 180 | 5% |
| | Riparian buffers | acres | 93 | 2% | 23 | 0.6% |
| | Barnyard runoff controls (equine) | acres | 4 | 23% | 5 | 28% |
| Cropland | Continuous no till | acres | 19.74 | 21% | 8.46 | 9% |
| | Cover crops | acres | 14.10 | 15% | 0.00 | 0% |
| | Riparian buffers | acres | 3.48 | 7% | 0.00 | 0% |
| | Sod waterways | acres | 0.00 | 0% | 0.41 | 2% |
| | Permanent vegetation on cropland | acres | 0.74 | 1% | 1.11 | 1% |
| Manure storage | Manure storage facility (equine) | facility | 3 | 16% | 6 | 29% |
| | Manure composting facility (equine) | facility | 2 | 9% | 3 | 16% |
| Residential Septic | Septic tank pumpout | pumpout | 85 | 50% | 0 | 0% |
| | Septic system repair | repair | 20 | 41% | 0 | 0% |
| | Conventional septic system | system | 19 | 42% | 0 | 0% |
| | Conventional septic system w/pump | system | 5 | 11% | 0 | 0% |
| | Alternative waste treatment | system | 2 | 5% | 0 | 0% |
| Residential/ Urban Stormwater | Raingardens | ac treated | 11.28 | 2% | 7.52 | 1% |
| | Bioretention filters | ac treated | 3.02 | 1% | 4.53 | 1% |
| | Riparian buffers | acres | 1.31 | 0.50% | 0.56 | 0.21% |
| | Turf to trees | acres | 15.27 | 4% | 6.55 | 2% |
| | Bioswales | ac treated | 10.54 | 3% | 15.81 | 4% |
| | Manufactured BMPs | ac treated | 3.02 | 1% | 4.53 | 1% |
| | Rainwater harvesting | ac treated | 0.19 | 0.04% | 0.45 | 0.09% |
| | Pervious pavement | acres | 0.00 | 0% | 0.25 | 0.05% |
| | Wetland restoration | ac treated | 0.8 | 0.15% | 0.8 | 0.15% |
| Transitional | Increased E&S enforcement | acres/yr | 2.3 | 100% | 2.3 | 100% |
| Pet waste | Pet waste education program | program | 0.33 | 100% | 0.00 | 0% |
| | Pet waste composters | composter | 5 | 1.5% | 5 | 1.5% |
| Bank erosion | Streambank stabilization | linear ft | 11,517 | 31% | 17,276 | 46% |
| Average annual fecal coliform load (cfu/yr) | | | 8.63E+12 | | 6.26E+12 | |
| % Violation of Instantaneous E. coli standard (235 cfu/100mL) | | | 8.43% | | 5.69% | |
| % Violation of Geometric mean E. coli standard (126 cfu/100mL) | | | 8.33% | | 0.00% | |
| Average annual sediment load (T/yr): Page Brook, Roseville, Spout | | | 162.85 | | 109.22 | |

Table 21. Timeline for implementation in the [Spout Run](#) watershed

| BMP Type | BMP | Units | Stage 1 | | Stage 2 | |
|---|--|-------------------|----------|--------------------|----------|--------------------|
| | | | Extent | % Land use treated | Extent | % Land use treated |
| Direct deposition | Livestock exclusion w/riparian buffers | feet | 5,648 | 63% | 1,412 | 15% |
| | Livestock exclusion w/reduced setback | feet | 1,540 | 17% | 385 | 4% |
| Pasture | Small acreage grazing system (equine) | acres | 174 | 9% | 43 | 2% |
| | Grazing system | acres | 637 | 31% | 159 | 8% |
| | Improved pasture management | acres | 159 | 8% | 478 | 24% |
| | Permanent vegetation on critical areas | acres | 81 | 4% | 122 | 6% |
| | Riparian buffers | acres | 14 | 2% | 4 | 0.5% |
| | Barnyard runoff controls (equine) | acres | 2 | 23% | 2 | 28% |
| Cropland | Continuous no till | acres | 13.02 | 21% | 5.58 | 9% |
| | Cover crops | acres | 9.30 | 15% | 0.00 | 0% |
| | Cropland buffers | acres | 0.92 | 3% | 0.00 | 0% |
| | Sod waterways | acres | 0.00 | 0% | 0.66 | 4% |
| | Permanent vegetation on cropland | acres | 1.24 | 2% | 1.86 | 3% |
| Manure storage | Manure storage facility (equine) | facility | 2 | 16% | 3 | 29% |
| | Manure composting facility (equine) | facility | 1 | 9% | 2 | 16% |
| Residential Septic | Septic tank pumpout | pumpout | 60 | 50% | 0 | 0% |
| | Connection to public sewer | connection | 5 | 15% | 0 | 0% |
| | Septic system repair | repair | 13 | 35% | 0 | 0% |
| | Conventional septic system | system | 12 | 38% | 0 | 0% |
| | Conventional septic system w/pump | system | 3 | 9% | 0 | 0% |
| | Alternative waste treatment | system | 1 | 3% | 0 | 0% |
| Residential/ Urban Stormwater | Raingardens | ac treated | 4.14 | 3% | 2.76 | 2% |
| | Bioretention filters | ac treated | 1.54 | 1% | 2.31 | 2% |
| | Riparian buffers | acres | 3.31 | 3% | 1.42 | 1% |
| | Turf to trees | acres | 5.91 | 4% | 2.53 | 2% |
| | Bioswales | ac treated | 4.30 | 3% | 6.45 | 5% |
| | Manufactured BMPs | ac treated | 1.54 | 1% | 2.31 | 2% |
| Transitional | Increased E&S enforcement | acres/yr | 2.3 | 100% | 2.3 | 100% |
| Pet waste | Pet waste education program | program | 0.33 | 100% | 0.00 | 0% |
| | Pet waste composters | composter | 5 | 5% | 5 | 5% |
| Streambank erosion | Streambank stabilization | linear ft of bank | 4,796 | 23% | 11,190 | 54% |
| Average annual fecal coliform load (cfu/yr) | | | 2.26E+13 | | 1.61E+13 | |
| % Violation of Instantaneous E. coli standard (235 cfu/100mL) | | | 6.46% | | 4.00% | |
| % Violation of Geometric mean E. coli standard (126 cfu/100mL) | | | 0% | | 0% | |
| Average annual sediment load (T/yr): Page Brook, Roseville, Spout | | | 162.85 | | 109.22 | |

Water Quality Monitoring

Improvements in water quality will be evaluated through water quality monitoring conducted by VADEQ. VADEQ will monitor three locations in the watersheds (Figure 2). Chemical monitoring of *E.coli* and field parameters including specific conductance, temperature and dissolved oxygen will be performed monthly at the stations shown in Figure 2. VADEQ will also conduct biological monitoring at the station located at the watershed outlet shown below in red. This monitoring will be conducted once a year in either the fall or spring.

Additional monitoring will be conducted by project partners including Friends of the Shenandoah River (FOSR) and Piedmont Environmental Council (PEC). FOSR has three monitoring stations in the watershed, one located on Roseville Run at the Boyce Sewage Treatment Plant outfall, one on Page Brook at the 617 bridge, and one on Spout Run near the watershed outlet at the 621 bridge. FOSR monitors nutrients, pH, dissolved oxygen, temperature and turbidity. In addition, FOSR will be conducting monitoring to evaluate the effectiveness of streambank restoration projects installed through the C-Spout Run NFWF grant while PEC will be partnering with FOSR and volunteers to conduct biological monitoring in support of the project.

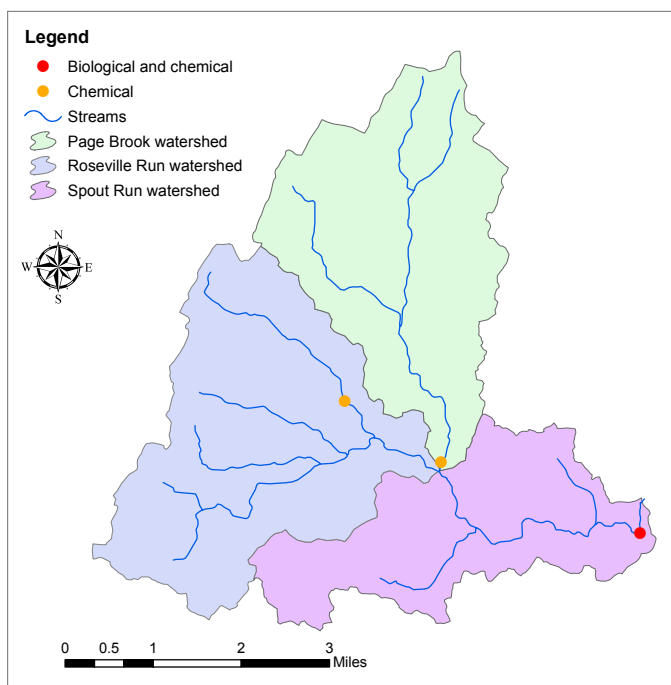


Figure 2. VADEQ monitoring stations

Throughout the development of the Spout Run sediment TMDL, and the development of this implementation plan, the local community has expressed concerns about the benthic impairment on Spout Run including the possibility that the benthic community structure present in the stream is actually typical of a low gradient spring creek like Spout Run where karst geology and associated marl soil formations are present throughout the riparian zone and stream channel. The steering committee agreed that additional benthic monitoring is needed throughout the watershed to fully assess the state of the benthic community. In addition, the committee recommended that a targeted benthic monitoring program be implemented in the watershed during Stage 1 in order to assess the impacts of streambank restoration projects planned over the next two years on the benthic community. Excluding streambank restoration, the majority of practices included in this plan that will reduce sediment loading in the stream will also address the bacteria impairment. Therefore, the extent of streambank stabilization needed to restore the stream was the primary BMP in question by the steering committee. Should monitoring show that the benthic community remains unchanged following streambank restoration, the committee recommended pursuing a Natural Conditions designation with VADEQ.

Targeting Implementation

Implicit in the process of a staged implementation is targeting of best management practices. Targeting ensures optimum utilization of limited technical and financial resources. The agricultural working group discussed potential targeting strategies of fencing practices and other agricultural BMPs. The group decided that it would be best to throw a wide net with respect to mailings promoting agricultural BMPs, and outreach events like farm tours and field days. However, the final agricultural BMP implementation scenario selected for this plan does include targeting with respect to cost effective BMPs, with the greatest proportion of fencing occurring in Stage 1 of the timeline. In addition, practices that are expected to be of greatest interest to producers (e.g. continuous no till, cover crops) are emphasized in the early years of implementation with the expectation that working with producers on these practices will allow agricultural conservation technicians to establish good relationships with farmers in the watershed. These strong relationships will be essential in achieving full implementation goals. The residential working group recommended a similar approach with stormwater BMPs. The most cost effective BMPs will be implemented first including riparian buffers and turf to tree plantings. The greatest proportion of more costly BMPs such as manufactured BMPs are scheduled for implementation in Stage 2. In addition, the residential working group recommended targeting a series of stormwater demonstration projects including rainwater harvesting and pervious pavers in the Roseville Run watershed. The pet waste education program including installation of pet waste composters and pet waste stations will be targeted in high density residential areas including the Towns of Boyce and Millboro.

Targeting Streambank Restoration

Considerable streambank restoration efforts will be needed in order to meet the TMDL goal of a 67% reduction in sediment from bank erosion. Due to the unique karst properties of Spout Run and the highly erodible Weaver soils found throughout the riparian zone and stream channel, there are portions of Spout Run where banks have become highly incised from erosion (10-20 foot vertical banks) despite a forested riparian area and lack of livestock access to the stream. The residential working group and steering committee discussed how these portions of the stream should be addressed based on the fact that the bank erosion observed is most likely due to natural conditions. It was determined that actively eroding banks due to human or livestock activity should be addressed first during Stage 1 of implementation. Many of these segments are located towards the headwaters of the stream. Impacts to the benthic community following these projects will be closely monitored by project partners including FOSR and PEC. Should considerable changes to the benthic community occur after restoration including increases in the abundance of sensitive species and overall diversity, additional projects will be pursued in Stage 2 of implementation. A 0.5 mile segment of Spout Run moving upstream from the watershed outlet towards Tilthammer Mill Road was identified by the steering committee as a particularly low priority for streambank restoration. While this reach of the stream has vertical exposed streambanks, the banks are made up of marl and clay soil formations, making them highly erodible. Several committee members noted that it is likely that there was a dam present in this area at one point in time, which may have affected the erosional sequence in this area. The map shown in

Figure 3 indicates reaches of high priority for implementation in Stage 1, and reaches of low priority for possible implementation in Stage 2 depending on benthic monitoring results.

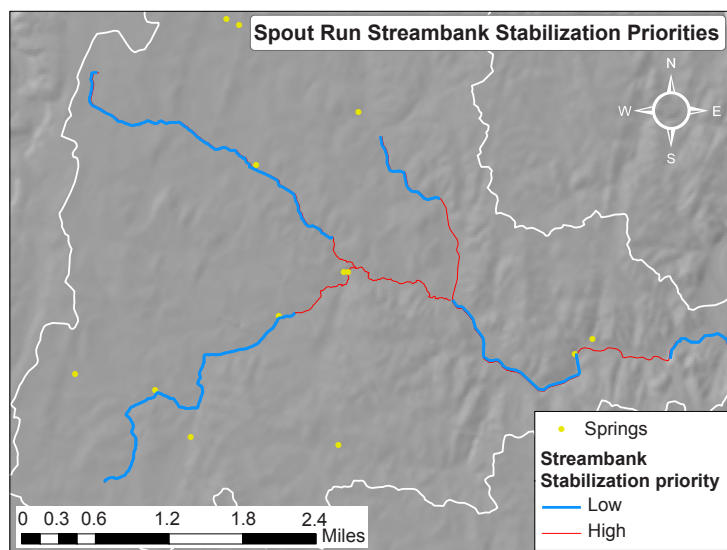


Figure 3. Streambank stabilization prioritization: Page Brook, Roseville Run and Spout Run

Fencing Prioritization by Subwatershed

While the agricultural working group decided targeting of livestock exclusion would not be necessary, an analysis of the water quality benefits of livestock exclusion was performed for each subwatershed in

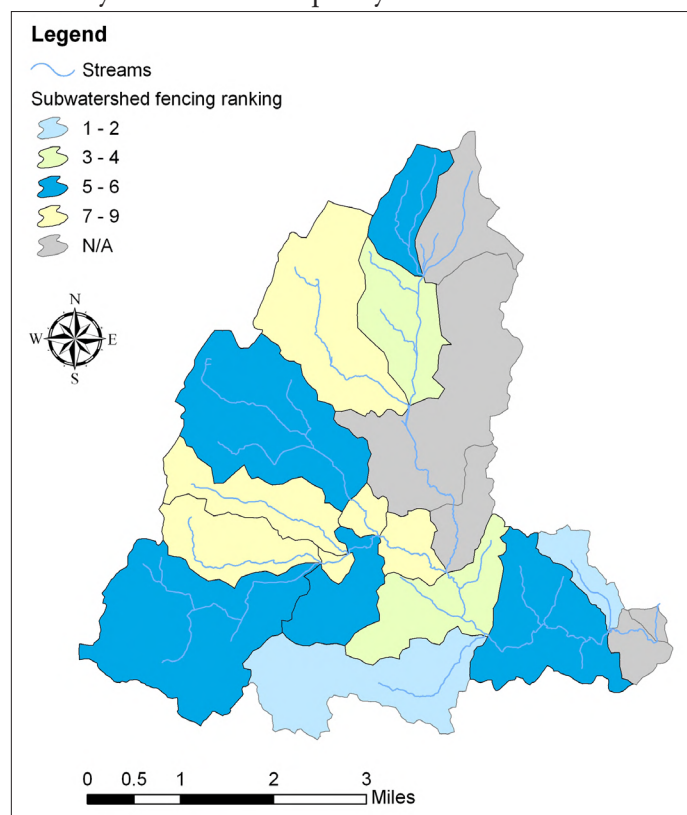


Figure 4. Fencing prioritization by subwatershed (1=highest priority)

order to provide additional information on opportunities for additional prioritization of livestock exclusion projects should it be determined that targeting would be useful further in to the project timeline (Figure 4). This analysis was accomplished by comparing the amount of bacteria livestock are contributing through direct deposition of manure into the stream, and the length of fencing needed. Each watershed was divided up into a series of smaller subwatersheds, which were then ranked in descending order based on the ratio of bacteria loading per fence length and proximity to the headwaters of the creeks. It should be noted that based on recent accomplishments of the Lord Fairfax SWCD and planned projects, it is expected that nearly all of Page Brook will be excluded from livestock in the next 2-3 years.

PARTNERS AND THEIR ROLE IN IMPLEMENTATION

Agricultural and Residential Landowners

SWCD and NRCS conservation staff often consider characteristics of farms and farmers in the watersheds that will affect the decisions farmers make when it comes to implementing conservation practices. For example, the average size of farms is an important factor to consider, since it affects how much cropland or pasture a farmer can give up for a riparian buffer. The age of a farmer may also influence their decision to implement best management practices. Table 22 provides a summary of relevant characteristics of farms and producers in Clarke County from the 2007 Agricultural Census. These characteristics were considered when developing implementation scenarios, and should be utilized to develop suitable education and outreach strategies.

Table 22. Characteristics of farms and farmers in Clarke County, VA (USDA, 2007)

| Characteristic | Number |
|--|-----------|
| Number of farms | 496 |
| Land in farms (acres) | 67,919 |
| Full owners of farms | 351 |
| Part owners of farms | 103 |
| Tenants | 42 |
| Operators identifying farming as their primary occupation | 235 |
| Operators identifying something other than farming as their primary occupation | 261 |
| Average age of primary operator | 58.8 |
| Average size of farm (acres) | 137 |
| Average market value of farmland and buildings (\$/acre) | \$6,827 |
| Average net cash farm income of operation (\$) | -\$10,488 |
| Average farm production expenses (\$) | \$59,056 |
| Farms with internet access | 360 |
| Farm typology (acres) | |
| Small family farms: retirement and residential/lifestyle | 296 |
| Small family farms: farming occupation | 95 |
| Large family farms | 9 |
| Nonfamily farms | 20 |
| Farm operations: partnerships | 45 |

In addition to local farmers, participation from homeowners, developers, local government staff and elected officials is also critical to the success of this plan. The extent of urban and residential BMPs called for in this plan is extensive, and will require consistent enforcement of erosion and sediment

control and stormwater management regulations during and after development, and active pursuit of funding for stormwater management retrofits in the watershed. In addition, residential property owners will need to make significant changes in their behavior including management of pet waste, mowing and landscaping practices in riparian areas, and septic system maintenance. Though the amount of bacteria that is coming from failing septic systems and straight pipes is minimal compared to livestock, human waste carries with it pathogens that can cause health problems above and beyond those associated with livestock manure.

Lord Fairfax SWCD and Natural Resource Conservation Service

During the implementation project, the SWCDs and NRCS will continue to reach out to farmers in the watersheds and provide them with technical and financial assistance with conservation practices. Their responsibilities include promoting available funding and the benefits of BMPs and providing assistance in the survey, design, and layout of agricultural BMPs. The SWCD and NRCS staff will conduct outreach activities in the watershed to encourage participation in conservation programs. Such activities include mailing out newsletters and organizing field days. The Lord Fairfax SWCD has two conservation technicians and a conservation specialist who cover Clarke, Warren, Frederick, and Shenandoah Counties along with the City of Winchester. It is recommended that the two conservation technicians work cooperatively in their efforts to increase local awareness of water quality issues in the creeks and make agricultural landowners aware of financial and technical assistance available for BMP implementation in the watersheds.

Clarke County

Decisions made by local governments regarding land use and zoning will play an important role in the implementation of this plan. Currently, Clarke County has zoning and land use policies in place that support the preservation of agricultural land and encourage good stewardship of natural resources. The location of the Spout Run watershed and its tributaries within Clarke County is such that it has not been subject to intense development pressures, making the predominant land uses in the watershed likely to remain in agriculture and forest. Local government support of this type of land conservation will become increasingly important as greater numbers of conservation measures are implemented across the watersheds. In addition, local government staff and elected officials will play an important role in ensuring compliance with existing stormwater management and erosion and sediment control regulations, which will be important in limiting the impacts of development on Spout Run.

Dedicated staff are currently not available to lead efforts to correct failing septic systems and straight pipes and urban/residential stormwater management. A partnership with the Department of Health, Clarke County and local watershed groups such as Friends of the Shenandoah River (FOSR) could be formed in order to provide technical support to meet septic and stormwater BMP goals. FOSR has previous experience administering a successful a pump-out program in the region and could be an excellent partner in future efforts.

Virginia Department of Environmental Quality

Improvements in water quality and implementation progress will be determined through monitoring conducted by the VA Department of Environmental Quality's (VADEQ) ambient and biological monitoring programs. The Code of Virginia directs VADEQ to maintain a list of impaired waters and to develop TMDLs to address impairments. When monitoring shows that a stream is no longer impaired, VADEQ is the agency responsible for removing that stream from the list. Every two years, VADEQ completes the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report. This report covers a five year period of water quality monitoring and includes the state's 303(d) Report on Impaired Waters and de-listings submitted to the Environmental Protection Agency for approval. VADEQ TMDL program staff will also provide support with education and outreach related to water quality and TMDLs in the Spout Run watershed throughout implementation.

Virginia Department of Conservation and Recreation

The Department of Conservation and Recreation (DCR) will work closely with project partners including the Lord Fairfax Soil and Water Conservation District to track implementation progress and provide cost share for agricultural best management practices through the Virginia Agricultural Cost Share Program. In addition, DCR will work with interested partners on grant proposals to generate funds for projects included in the implementation plan that are not funded through state and federal cost share programs such as septic system repairs and replacements. When needed, DCR will facilitate additional meetings of the steering committee to discuss implementation progress and make necessary adjustments to the implementation plan.

The Downstream Project

The Downstream Project will play a key role in education and outreach for this project through the development of a multimedia outreach campaign to promote the C-Spout Run partnership and the projects completed through the C-Spout Run NFWF Grant initiative. This effort will be instrumental in generating the momentum and public awareness that will be needed to complete this project over a 10 year period. Downstream is already utilizing a Wordpress blog to capture and share general information about the TMDL process, objectives, planning efforts, and current activities in the Spout Run watershed and will continue to share and promote the results of all phases of the project on the primary site and on partner sites. Short progress videos documenting a series of streambank restoration projects and still photographs will be added to the Weblog as a video journal of the project. Email and RSS feeds will be used to notify subscribers and partner lists of postings and progress. At the end of the grant project the video journal will be combined into a single piece on DVD. In addition, The Downstream Project will continue to develop a unique interactive map of the watershed utilizing geo-referenced photos currently being posted on the Spout Run website to document over time, the effectiveness of stream restoration efforts.

C-Spout Run Partnership and Other Potential Local Partners

The C-Spout Run partnership currently includes the following organizations:

- Friends of the Shenandoah River
- Piedmont Environmental Council
- Trout Unlimited
- Lord Fairfax SWCD
- The Downstream Project
- Clarke County
- Northern Shenandoah Valley Regional Commission
- Virginia Department of Conservation and Recreation
- Virginia Department of Environmental Quality

There are numerous additional opportunities for future partnerships in the implementation of this plan and the partnership noted above. Additional potential partners in implementation include:

- Virginia Cooperative Extension
- Virginia Outdoors Foundation
- Clarke County Equine Association
- Clarke County Historical Association
- The Shenandoah Riverkeeper
- County schools and the Powhatan School
- Clarke County Master Naturalists and Master Gardeners
- Virginia Farm Bureau
- Blue Ridge Cattleman's Association

INTEGRATION WITH OTHER WATERSHED PLANS

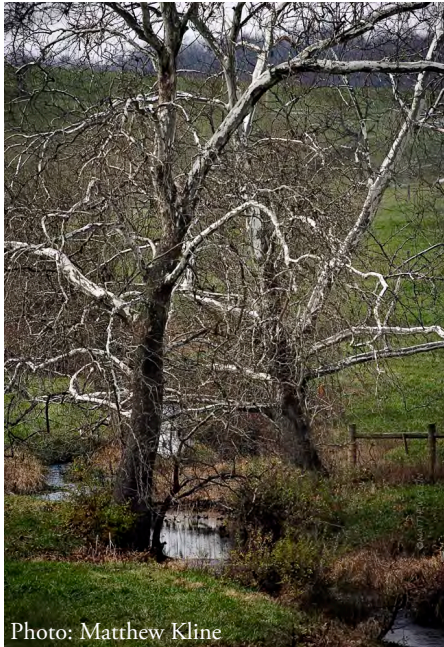


Photo: Matthew Kline

Each watershed in the state is under the jurisdiction of a multitude of water quality programs and activities, many of which have specific geographic boundaries and goals. Coordination of the implementation project with these existing programs could make additional resources available and increase participation by local landowners.

Clarke County Comprehensive Plan

The Clarke County Comprehensive Plan includes several sections dedicated to the protection of natural resources including water and groundwater resource plans. The portion of the water resources plan that directly addresses surface water identifies Spout Run as a high priority with respect to BMP implementation to improve water quality. A series of implementation steps are recommended in this plan including amending the zoning

ordinance to require 100 foot building setbacks from perennial streams and springs (this requirement was adopted by the County in 1999), establishing a countywide surface water monitoring network, and encouraging installation of BMPs to reduce access of livestock to riparian buffer zones. These recommended steps will be directly supported through the implementation of this plan in the Spout Run watershed. Among the additional objectives and associated policies established in comprehensive plan is the encouragement of the use of BMPs to improve water quality as outlined in the TMDL program by making technical assistance available to landowners, promoting awareness of BMP programs and stormwater management regulations, assisting with the development of conservation plans for farms located next to streams, and encouraging landowners to work with conservation partners such as Virginia Cooperative Extension Service, the Natural Resource Conservation Service, the Lord Fairfax Soil and Water Conservation District on BMP implementation. The plan also notes the need to support ongoing source water protection efforts for the Prospect Hills Spring Conservation District (the primary water source for the Town of Boyce), and the Millwood and White Post Public Water System (Clarke County, 2007).

In addition, Clarke County has passed a series of ordinances and zoning regulations that will directly support the implementation of this plan including:

- Flood Plain Ordinance
- Spring Conservation Overlay District
- Stream Protection Overlay District
- Septic Ordinance
- Well Ordinance
- Sinkhole Ordinance

Virginia's Phase II Chesapeake Bay Watershed Implementation Plan

Virginia's Watershed Implementation Plan (WIP) outlines a series of BMPs, programs and regulations that will be implemented across the state in order to meet nitrogen, phosphorous, and sediment loading reductions called for in the Chesapeake Bay TMDL, completed in December, 2010. The TMDL is designed to ensure that all pollution control measures needed to fully restore the Bay are in place by 2025, with at least 60 percent of the actions completed by 2017. A number of the BMPs included in this implementation plan are also found in Virginia's WIP. Consequently, Clarke County will be able to track and receive credit for progress in meeting Phase II WIP goals while also working towards implementation goals established in this plan to improve local water quality. For more information about Virginia's Phase II WIP, please visit DCR's Bay TMDL webpage: <http://www.dcr.virginia.gov/vabaytmdl/index.shtml>

Additional Natural Resource Management and Conservation Planning

There are a number of organizations working to implement natural resource management and land conservation plans in the watersheds. The Virginia Department of Game and Inland Fisheries is currently working to implement the "[Northern Bobwhite Quail Action Plan for Virginia](#)," which includes a series of recommended management practices that will also help to improve water quality by reducing runoff and filtering out pollutants before they reach the stream. In addition, organizations like the [Potomac Conservancy](#), [Clarke County](#), [Virginia Outdoors Foundation](#), [Department of Forestry](#), [Department of Historic Resources](#), and the [Piedmont Environmental Council](#) are working to preserve agricultural land in the watersheds through conservation easements. These easements can include some form of riparian buffer protection, and also help to ensure the longevity of efforts made to implement conservation practices on agricultural land. Whenever possible, efforts should be made to integrate the implementation of these and other conservation-related plans that will impact water quality with this plan for Spout Run and its tributaries.

FUNDING FOR IMPLEMENTATION

A list of potential funding sources available for implementation has been developed. Detailed descriptions can be obtained from the Lord Fairfax SWCD, VADCR, Natural Resources Conservation Service, and Virginia Cooperative Extension. While funding is being provided to the Lord Fairfax SWCD for agricultural BMPs and technical assistance for farmers, an additional funding commitment is needed to fully implement the agricultural, residential and urban practices included in the plan.

Virginia Agricultural Best Management Practices Cost-Share Program

The cost-share program is funded with state and federal monies through local SWCDs. SWCDs administer the program to encourage farmers and landowners to use BMPs on their land to better control transportation of pollutants into our waters due to excessive surface flow, erosion, leaching, and inadequate animal waste management. Program participants are recruited by SWCDs based upon those factors, which have a great impact on water quality. Cost-share is typically 75% of the actual cost, not to exceed the local maximum.

Virginia Agricultural Best Management Practices Tax Credit Program

For all taxable years, any individual or corporation engaged in agricultural production for market, who has in place a soil conservation plan approved by the local SWCD, is allowed a credit against the tax imposed by Section 58.1-320 of an amount equaling 25% of the first \$70,000 expended for agricultural best management practices by the individual. The amount of the credit cannot exceed \$17,500 or the total amount of the tax imposed by this program (whichever is less) in the year the project was completed. This program can be used independently or in conjunction with other cost-share programs on the stakeholder's portion of BMP costs. It is also approved for use in supplementing the cost of repairs to streamside fencing.

Virginia Agricultural Best Management Practices Loan Program

Loan requests are accepted through VADEQ. The interest rate is 3% per year and the term of the loan coincides with the life span of the practice. To be eligible for the loan, the BMP must be included in a conservation plan approved by the local SWCD Board. The minimum loan amount is \$5,000; there is no maximum limit. Eligible BMPs include 23 structural practices such as animal waste control facilities, and grazing land protection systems. The loans are administered through participating lending institutions.

Virginia Small Business Environmental Assistance Fund Loan Program

The Fund, administered through VADEQ, is used to make loans or to guarantee loans to small businesses for the purchase and installation of environmental pollution control equipment, equipment to implement voluntary pollution prevention measures, or equipment and structures to implement agricultural BMPs. The loans are available in amounts up to \$50,000 and will carry an interest rate of 3%, with repayment terms based on the borrower's ability to repay and the life of the equipment being

purchased or the life of the BMP being implemented. To be eligible for assistance, a business must employ 100 or fewer people and be classified as a small business under the federal Small Business Act.

Virginia Water Quality Improvement Fund

This is a permanent, non-reverting fund established by the Commonwealth of Virginia in order to assist local stakeholders in reducing point and nonpoint nutrient loads to surface waters. Eligible recipients include local governments, SWCDs, and individuals. Grants for point sources are administered through VADEQ and grants for nonpoint sources are administered through VADCR.

Conservation Reserve Program (CRP)

Through this program, cost-share assistance is available to establish cover of trees or herbaceous vegetation on cropland. To be eligible for consideration, the following criteria must be met: 1) cropland was planted or considered planted in an agricultural commodity for two of the five most recent crop years, and 2) cropland is classified as “highly-erodible” by NRCS. The payment to the participant is up to 50% of the cost for establishing ground cover.

Conservation Reserve Enhancement Program (CREP)

This program is an “enhancement” of the existing Farm Service Agency (FSA) CRP Continuous Sign-up. It has been “enhanced” by increasing the rental rates, and offering incentive payments to place the enrolled area under a 10-15 year contract. The average cost share payment in this program is 75%; however, additional incentives are available to raise this rate if a landowner is willing to install additional control measures. Pasture and cropland adjacent to streams, seeps, springs, ponds and sinkholes are eligible to be enrolled. Buffers consisting of native, warm-season grasses on cropland, and mixed hardwood trees on pasture, must be established in widths ranging from the minimum of 30% of the floodplain or 35 feet, whichever is greater, to a maximum average of 300 feet. Federal cost-sharing (50%) is available to help pay for fencing to exclude livestock from the riparian buffer, watering facilities, hardwood tree planting, filter strip establishment, and wetland restoration. The Loud Fairfax SWCD also provides a cost share payment. The State of Virginia will make an additional payment to landowners who elect to place a perpetual easement on the enrolled area.

Environmental Quality Incentives Program (EQIP)

Approximately 65% of the EQIP funding for the state of Virginia is directed toward “Priority Areas.” These areas are selected from proposals submitted by a locally led conservation work group. The remaining 35% of the funds are directed toward statewide priority concerns of environmental needs. EQIP offers up to 10-year contracts to landowners and farmers to provide financial assistance, and/or incentive payments to implement conservation practices and address the priority concerns statewide or in the priority area. Eligibility is limited to persons who are engaged in livestock or agricultural production.

EPA Section 319 Grant Project Funds

Through Section 319 of the Federal Clean Water Act, Virginia is awarded grant funds to implement

NPS programs. The VADCR administers the money annually on a competitive grant basis to fund TMDL implementation projects, outreach and educational activities, water quality monitoring, and technical assistance for staff of local sponsor(s) coordinating implementation. In order to meet eligibility criteria established for 319 funding, all proposed project activities must be included in the TMDL implementation plan covering the project area. In addition, this plan must include the nine key elements of a watershed based plan identified by EPA (see Guidance Manual for TMDL Implementation Plans, VA Departments of Conservation and Recreation and Environmental Quality, July 2003).

Chesapeake Bay Watershed Initiative

This initiative was authorized in the 2008 Farm Bill for 2009-2012. It provides technical and financial assistance to producers to implement practices that reduce sediment and nutrients to help protect and restore the Chesapeake Bay. Priority has been given to the Shenandoah and Potomac River Basins and selected watersheds that have impaired streams due to high levels of nutrients and sediment. Producers who live in an NRCS high priority Chesapeake Bay watershed receive additional consideration.

Wildlife Habitat Incentive Program (WHIP)

WHIP is a voluntary program for landowners who want to develop or improve wildlife habitat on private agricultural lands. Participants work with NRCS to prepare a wildlife habitat development plan. This plan describes the landowner's goals for improving wildlife habitat and includes a list of practices and a schedule for installation. A 10-year contract provides cost-share and technical assistance to carry out the plan. Cost-share assistance of up to 75% of the total cost of installation (not to exceed \$10,000 per applicant) is available for establishing habitat. Types of practices include: disking, prescribed burning, mowing, planting habitat, converting fescue to warm season grasses, establishing riparian buffers, creating habitat for waterfowl, and installing filter strips, field borders and hedgerows.

Wetland Reserve Program (WRP)

This program is a voluntary program to restore and protect wetlands on private property. Landowners who choose to participate in WRP may receive payments for a conservation easement or cost-share assistance for a wetland restoration agreement. The landowner will retain ownership but voluntarily limits future use of the land. To be eligible for WRP, land must be suitable for restoration (formerly wetland and drained) or connect to adjacent wetlands. A landowner continues to control access to the land and may lease the land for hunting, fishing, or other undeveloped recreational activities.

Southeast Rural Community Assistance Project (SE/R-CAP)

The mission of this project is to promote, cultivate, and encourage the development of water and wastewater facilities to serve low-income residents at affordable costs and to support other development activities that will improve the quality of life in rural areas. Staff members of other community organizations complement the SE/R-CAP staff across the region. They can provide (at no cost): on-site technical assistance and consultation, operation and maintenance/management assistance, training, education, facilitation, volunteers, and financial assistance. Financial assistance includes \$1,500 toward repair/replacement/ installation of a septic system and \$2,000 toward repair/replacement/in-

stallation of an alternative waste treatment system. Funding is only available for families making less than 125% of the federal poverty level.

National Fish and Wildlife Foundation

Grant proposals for this funding are accepted throughout the year and processed during fixed sign up periods. There are two decision cycles per year. Each cycle consists of a pre-proposal evaluation, a full proposal evaluation, and a Board of Directors' decision. Grants generally range between \$10,000 and \$150,000. Grants are awarded for the purpose of conserving fish, wildlife, plants, and their habitats. Special grant programs are listed and described on the NFWF website (<http://www.nfwf.org>). If the project does not fall into the criteria of any special grant programs, a proposal may be submitted as a general grant if it falls under the following guidelines: 1) it promotes fish, wildlife and habitat conservation, 2) it involves other conservation and community interests, 3) it leverages available funding, and 4) project outcomes are evaluated.

Virginia Natural Resources Commitment Fund

This fund was established in the Virginia Code as a subfund of the Water Quality Improvement Fund in 2008. Monies placed in the fund are to be used solely for the Virginia Agricultural BMP Cost Share Program as well as agricultural needs for targeted TMDL implementation areas.

Clean Water State Revolving Fund

EPA awards grants to states to capitalize their Clean Water State Revolving Funds (CWSRFs). The states, through the CWSRF, make loans for high-priority water quality activities. As loan recipients make payments back into the fund, money is available for new loans to be issued to other recipients. Eligible projects include point source, nonpoint source and estuary protection projects. Point source projects typically include building wastewater treatment facilities, combined sewer overflow and sanitary sewer overflow correction, urban stormwater control, and water quality aspects of landfill projects. Nonpoint source projects include agricultural, silvicultural, rural, and some urban runoff control; on-site wastewater disposal systems (septic tanks); land conservation and riparian buffers; leaking underground storage tank remediation, etc.

Wetland and Stream Mitigation Banking

Mitigation banks are sites where aquatic resources such as wetlands, streams, and streamside buffers are restored, created, enhanced, or in exceptional circumstances, preserved expressly for the purpose of providing compensatory mitigation in advance of authorized impacts to similar resources. Mitigation banking is a commercial venture which provides compensation for aquatic resources in financially and environmentally preferable ways. Not every site or property is suitable for mitigation banking. Wetlands and streams are complex systems, and their restoration, creation, enhancement, or preservation often requires specialized knowledge. Mitigation banks are required to be protected in perpetuity, to provide financial assurances, and long term stewardship. The mitigation banking processes is overseen by the Inter-Agency Review Team (IRT) consisting of state and federal agencies and chaired by DEQ and Army Corps of Engineers (ACOE). For more information, contact the ACOE or DEQ's Water Protection Program.

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